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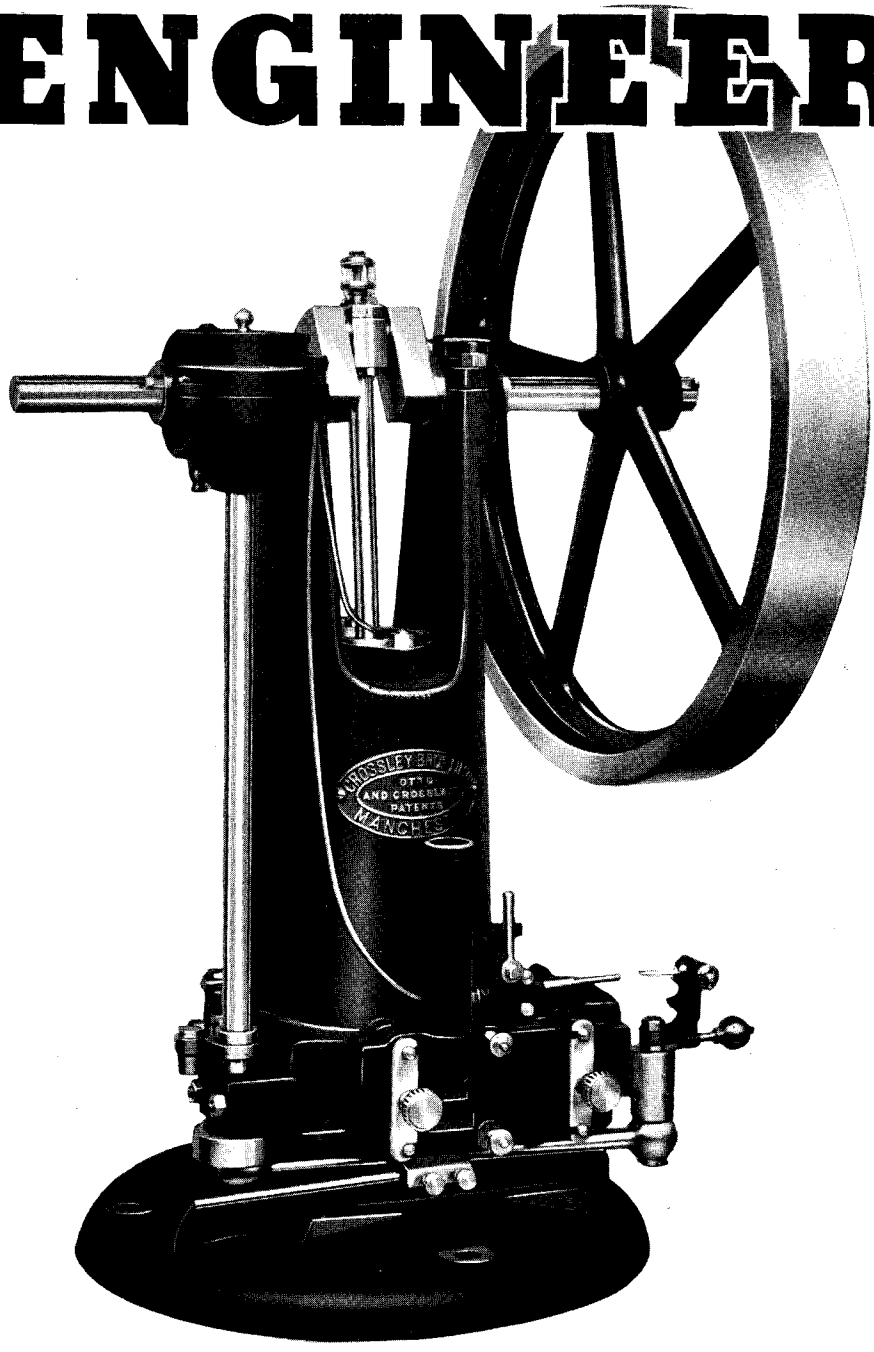
THE MODEL ENGINEER



CHRISTMAS NUMBER

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

6TH DECEMBER 1951 VOL. 105 NO. 2637

SMOKE RINGS

This Issue

● ONCE AGAIN, Christmas is drawing near, and this issue of the "M.E." is rather in the nature of a special one. It is 24 pages larger than normal; it carries a considerably augmented advertisement section, so that our advertisers can have an opportunity of announcing their wares just at a time when readers are trying to decide what to buy as presents for friends and relatives; it gives the reader more to read in the editorial section, and some of the extra material is in appropriately light-hearted vein; the cover has received special treatment to give added attraction to an attractive subject. We trust that readers will find this issue no less useful, interesting and entertaining than usual.

Model Road Racing

● THE INTEREST created by the articles which appeared in THE MODEL ENGINEER a few weeks ago, relating to model road-racing, proved beyond all doubt that the true functional scale model has already triumphed over the twirling "spin-dizzies" of yesteryear.

In all fields of development there is the awkward initial period when, for want of facts and experience, an ideal appears to have been reached when, in reality, a state of unbalanced compromise is all that exists. The development of the r.t.p. model racing car has been no exception to this rule, and it is a fact that although great strides have been taken since its innovation a few years ago, the stress was placed upon *function* rather than the desirable blend of *realism and function*, with the result that the outcome lacked general appeal.

The model Grand Prix car is, as the term implies, a perfect scale replica of its full-sized counterpart and, with its fully-concealed power unit, clutch transmission and miniature driver, it presents a spectacle which closely emanates the performance of the latter. Further realism is added by the method of racing—i.e. car against car, instead of car against clock—and the circuit itself, with its right- and left-hand bends, hair-pins, sweeping curves, hill climbs and descents is a vast improvement on the banked ovals, which were the first development on the r.t.p. circuits.

Next week we will publish the first of a series of articles by Mr. Rex Hays, the well-known motor modeller, on the construction of the "M.E." Grand Prix car, which is a detailed 1/12th scale model of the 158 Alfa Romeo.

The model has undergone rigorous tests, and several modifications have been carried out to bring it up to the high standard of efficiency expected by our readers.

"A Little Nonsense!"

● WE PUBLISH in this issue the first of a series of humorous cartoons by the well-known cartoonist, Rick Elmes, who, in common with many others who follow artistic pursuits, either in a professional or amateur capacity, is also keen on model work, and as will be evident, has a very sound practical knowledge of what *can* happen in the model workshop. No doubt there are some of our readers who will say that the pages of THE MODEL ENGINEER should be used exclusively for more serious technical topics, but an odd corner devoted to lighter matters now and then is a refreshing change, especially when it can be used to point a moral, as in this case. Mr. Elmes does not imply that any of our readers would do the terrible things suggested in these cartoons—the idea is unthinkable!—but—well, we will just hand out the familiar quotation "Many a true word spoken in jest," and leave it at that!

Drawings for Historical Ship Models

● THOSE OF our readers who read our pre-war magazine *Ships and Ship Models* will remember the name of Clive Millward, who sometimes wrote under the name of "Nautilus" in connection with articles on historical ships. During the war we lost touch with him, but a year or two ago we were deeply grieved when we learnt that he was killed during the war, in which he served as a pilot in the R.A.F. Through Mr. Battson, the author of two of our ship modelling books, we ultimately got in touch with Mrs. Millward and found she had a large number of her husband's drawings, comprising some thirty complete sets of historical ships, from the Viking Longship of A.D. 900 to the frigate of 1775, including the *Endeavour Bark* and the *Bounty*. Mr. Millward had a profound knowledge of historical ships, was careful and painstaking in his research work, and particularly expert on the question of rigging. Added to this he was an artist of no mean order, and his drawings, especially of models of the Restoration period, with their wealth of carved decoration, are a delight to the eye, apart from their value to the ship modeller. By arrangement with Mrs. Millward we are now able to make these drawings available to the ship-modeller, and they are being added to our new plans list, which will be published shortly. The section dealing with ships has been enlarged to such an extent that a separate list is now necessary. This will be announced in our advertisement pages as soon as it is available, and those of our readers who are interested in ships will find our list of the greatest value, whether they build historical models, yachts, power boats or liners and whether their models are for sailing or for exhibition.

Electrical Timing Devices

● CONSIDERABLE PROGRESS has been made, in the last few years, in the development of racing models of all types; so much so, indeed, that the problems of timing races accurately has become a major problem. We are constantly being reminded of this fact by the many enquiries we receive for advice on methods and apparatus suitable for timing high-speed models. Although a large number of ingenious and thoroughly reliable devices for the electrical control of stop watches and chronometers, and also recording chronographs, have been published at various times in THE MODEL ENGINEER, there is still a demand for further information on this subject. In the issue of THE MODEL ENGINEER dated August 16th, we published details of a competition sponsored by Mr. F. G. Buck, who has himself contributed substantially to the development of timing apparatus for new and improved designs of these devices. At the time of writing this paragraph, the response to this has been practically negligible, which is disappointing, to say the least; and in view of the fervent interest in speed, in certain model engineering quarters, we strongly urge that the devotees of racing models should pause for a moment in their high-velocity rush to consider some of the incidental but highly necessary problems involved in its pursuit. As a model locomotive constructor must necessarily pay a great deal of attention to track accessories and equipment, so the constructor of racing models may be expected to show an equal sense of proportion in assisting to produce timing gear, safety devices and other essential adjuncts to the practical running and control of his particular activities.

A South African Revival

● WE HAVE received a letter from Mr. A. Hood, of Pietermaritzburg, to let us know that a meeting was held there on September 11th last and, as a result, the Pietermaritzburg Society of Model Engineers has been resuscitated. At the Royal Agricultural Show held in Pietermaritzburg last June, the Durban S.M.E. had staged an exhibition which proved to be a great attraction; it awakened the enthusiasm of local model engineers who eventually held the meeting referred to above. We sincerely hope that the resuscitated club will prosper from now on.

Can Any Readers Help?

● AT THE Canadian Red Cross Memorial Hospital at Taplow, Bucks, there is a Special Unit for children suffering from rheumatic fever, most of whom are in-patients for a very long period of time.

At Christmas, the authorities try to make a special effort for these young patients, and this year, they are trying to arrange a display, based on the Festival of Britain, for boys over twelve. For this purpose, the loan is required of any kind of model appropriate to such a theme; the models would be taken every care of and would be required for only about three weeks.

Any reader willing to respond to this appeal is requested to communicate with Dr. E. M. M. Besterman at the hospital. Although Taplow is in Buckinghamshire, the address, for postal reasons, is: Ward 3, Canadian Red Cross Memorial Hospital, Taplow, near Maidenhead, *Berks*.

ROUND TOWN IN THE 'NINETIES

Describing Some of the Interesting Engines to be seen–and heard

by B.C.J.

MOST engineers rather early in life must, one imagines, have had the experience of becoming completely absorbed in some attractive feature of their calling, some machine or device perhaps which soon became an interest far beyond all others—an obsession which would not be denied.

Such an experience came my way in the early nineties and was occasioned by frequent visits to an electrical exhibition held in a building not far south of the Metropolis, a building now no longer standing—destroyed by consuming fire!

In my own case the obsession—for obsession it certainly could be called—was the gas engine; a machine that was being rapidly developed and brought into use at the above period.

Now the attractive features of the gas engine were indeed many... generally it could be put in motion in *two* minutes, always in *ten*; it was a slow running machine (it could be *seen* running) 120, 160, 180, 200 r.p.m. were common speeds; it had novel mechanical features—side shaft, cams, skew gears, hit and miss governor, oiling devices, hot tube ignition—and all these varied according to make and size of engine. Yes! indeed there was something to see in the nineties.

As a pupil at University College in Gower Street, the whole of London was available—available for inter-lecture perigrinations. These took me again and again to some district where a gas engine—or several gas engines—could be seen and enjoyed. And, be it noted, all these engines were *in motion*, though maybe some of them merely running round without load. But load or no load it mattered little—there was always some interesting feature. So reader if you are peradventure interested in the history and development of the gas engine—not forgetting the oil and hot air engine—accompany me, if you will, on a tour round town, and I will attempt to describe some of these machines—displayed as they were in the 'nineties—but as they certainly are *not* now!

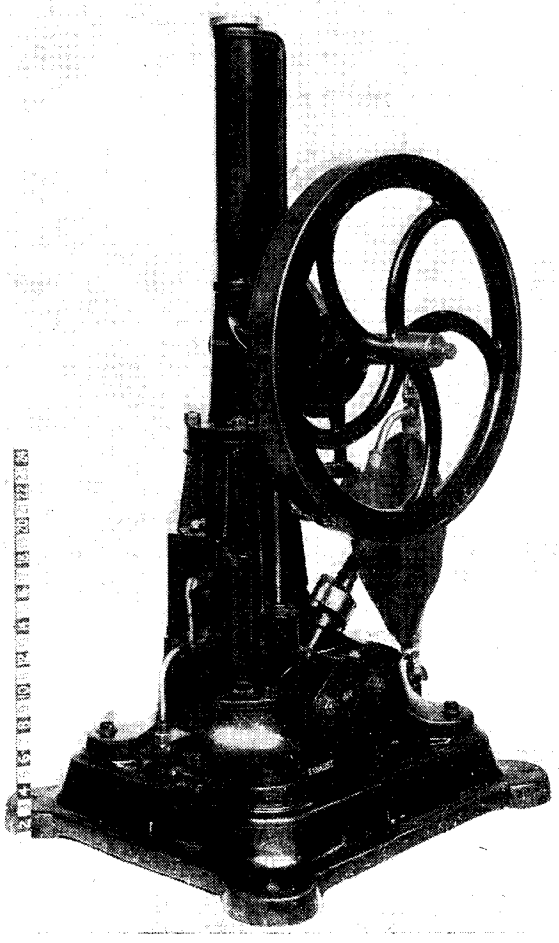


Fig. 1. Small Bisschop non-compression gas engine with Desaxe cylinder and flame ignition. Air cooled

A Bisschop Gas Engine in a Butcher's Shop

In the 'nineties there must have been a very considerable demand for small engines to provide power for all sorts of appliances for which the small steam engine could not well be brought into use. It could not be brought into use, for steam was not *on tap*, and had to be generated. This took time and when the steam was available there was no demand for it perhaps (There were, too, other

objections—stoking, fuel, feedwater, and an attendant to look after these matters). So that certain clever people got busy and designed small engines operated by gas, and one of them is illustrated in Fig. 1 and a very unusual little machine it was. The crank, which was *desaxe* (see Fig. 2) was above the cylinder. There was no compression, ignition was by open flame and a piston valve controlled the exhaust discharge. The air valve was composed of rubber, so were the two gas-bags, while it possessed no water jacket. An eccentric operated the exhaust valve—

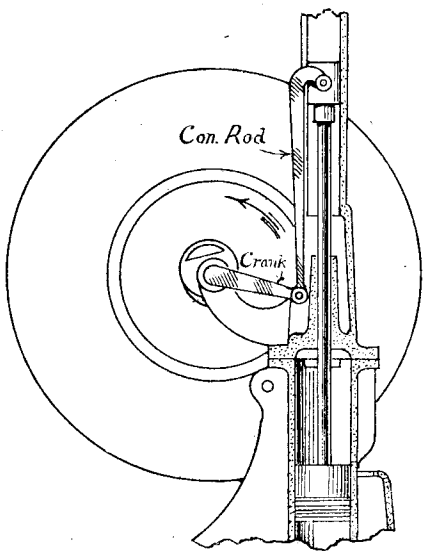


Fig. 2. Sketch of Bisschop engine, showing application of Desaxe system

and there were other eccentricities. Indeed it would almost seem as though the designer had set himself the task of doing things to a gas engine such as had never been done before. But the things that he had done did not stop the engine from working. Indeed it invariably went on working—until somebody turned the gas off.

I well remember one of these little machines at work in a small butcher's shop near Smithfield Market. I cannot recollect whether it was driving a meat chopper or a sausage machine, or indeed what work it was that caused this engine to become so heated with its exertions and pant so loudly from its exhaust outlet and in short to appear so distressed. But the engine, though uneconomical, was successful, I think some thousands were turned out at Andrews works.

I do not ever remember having seen or heard of a model of one of these little engines and yet, with the exception of some rather elaborate pattern making, there would appear to be no constructional difficulty. I would just recommend the following, however—a well fitting lapped piston lubricated, nót with oil, but with powdered *black-lead* which should cut down friction to zero. Secondly, instead of the small suspended disc valve in the firing port, I would suggest a " touch-hole " without valve as being less obstructive to the ignition flame. (The size of the touch hole to be determined experimentally but in any case it would be less than $\frac{1}{16}$ of an in. in diameter.)

I imagine there must have been a great number of these small engines drawing in town gas at the rate of 20, 30 or more cu. ft. per hour and throwing volumes of exhaust gas into the streets—in exchange. But I never came across them. I expect there are derelict engines here and there, and there is an example, certainly, which for many years has rested at the Kensington Science Museum—to be picked to pieces, alas, as far as possible by generations of small boys.

An " Otto " Gas Engine of Early Origin

A few minutes' walk from Kings Cross station in the early 'nineties there was another butcher's shop. And right in the forefront of this shop was to be seen running a heavy looking gas engine which I feel sure must have been constructed at the " Otto " works in Germany—where the " Otto cycle " as a practical principle was born. It had all the characteristic features of such engines—a heavy slide valve at the back end of the cylinder, a flickering flame for ignition, a substantial trunk guide, bevel side-shaft drive, a belt-driven lubricator of bell shape upon the cylinder, a very heavy crankshaft and flywheel, a small and sightly governor—and as conclusive evidence of German origin this powerful engine was painted *brown*, I do not think that any Crossley-built engine of the period displayed itself in any raiment other than a very attractive *blue*. I may be wrong.

I remember that the engine was surrounded by wire-fencing of stout construction—which had a strong appeal to me. Dangerous animals at the zoo were caged, so why not a gas engine which was dangerous too—it might explode : according to information supplied at the time, indeed, it was always exploding. That was how it spent its working days.

There is an excellent illustration of this engine on page 167 of Dugald Clerk's book " The Gas Engine," 1893 edition.

You would not find this engine at work today, it has long since ceased to function as was its custom in the past. It was the first gas engine I remember to have seen and therefore I like to recall it. I remember asking a friend at the time what it was. " *It's a gas engine* " he replied. I could not imagine how gas could make an engine go, so I kept silent about it.

Hurst of Holborn

If one walked along the south side of Holborn, shortly after passing Chancery Lane, there was an attractive model-shop run by a wizard of the name of Hurst. There were two major attractions here—Mr. Hurst himself and a very nice little Crossley gas engine, which is shown well on the cover of this issue of THE MODEL ENGINEER. Mr. Hurst first. His was a very attractive personality—fair hair, clean shaven, blue eyed, always willing to give a little help or advice and always patient with what I fear he may have considered a most tiresome customer—the writer of these notes. I seem to have paid a number of visits to this particular model shop to request Mr. H. to make me a small piston, drill a few

holes, alter a connecting rod, or indeed any odd job which was beyond the resources of my workshop(?), and while matters were in hand I was not dull or impatient for I could always interest myself in the little Crossley engine securely bolted to the floor at the rear of Mr. H's showroom. So much for Mr. Hurst and I wish I could think of him as still among the living, but reckoning the years since I last saw him I fear this cannot be.

Now for the engine. Rather a nicely designed little machine it was occupying little floor space and having its vital parts fully in view and accessable. The slide-valve was unusual—it had to be held up to its working face by a cover and two strong springs. Leakage occurred if the spring pressure was not sufficient. This valve controlled the inlet of gas and air to the cylinder and in addition it controlled the somewhat elaborate system of ports and passages which with the assistance of an external flame, protected by a chimney, ignited the mixture in the cylinder at the moment of maximum compression. The whole system decidedly complicated and shortly making way for the much simpler hot-tube. Still a point in favour of these engines was the short period of time required to get them going—a turn of a gas-cock, a gas jet lighted with a match, a few pulls on the spokes of the flywheel an ignition of the mixture and she was off—Tew-Tew-Tew-che—Tew-che—Tew—Tew-che—Tew-che. I am sorry that I cannot give you a better rendering of the noise made by the small gas engine of the 'nineties.

As to model making one cannot be encouraging, for it would be difficult to imagine an engine less well adapted to the model maker's art—I refer of course to a *working* model. If one cares to make a model for compressed air operation, well and good. But a perfect working model! No.

In the window of Mr. Hurst's shop there were at one time several beautifully made models—a steam engine mounted on a polished oak base and a working four-cycle gas engine. Before finally closing down I think the business developed into Hurst & Lloyd—but I expect this firm is now no more.

I had almost forgotten to mention the extremely fascinating little inertia pendulum governor (see Fig. 4) fitted to Mr. Hurst's engine and operating on the hit and miss system—also fitted to other small gas and oil engines. The drawing should make the principle clear.

A Robust Crossley Engine near Ludgate Circus

In a street leading from Holborn to Ludgate Circus (Furnival Street?) Crossley Bros. at one time had a showroom. With my propensity for sniffing out a gas-driven engine I very soon located a very fine specimen of a Crossley engine hereabouts.

I remember it rather well and I will endeavour to give the reader an impression of it. . . . Two very heavy flywheels—they must have been five or more feet in diameter and proportionally wide in the rim—9 in. perhaps—first attracted the attention. They had curved spokes and revolving at about 200 r.p.m. they presented a pleasing sight, as did the well supported cylinder, substantial bed, valve mechanism, governor, lubricator and all the several accessories common to engines of the period.

Now this very *heavy* engine was running *light*—it had no load on it—and consequently the hit-and-miss governor was pretty frequently called upon to function. It functioned to such good effect that my observations frequently recorded *six* misses to *one* hit only. (If rifle-shooting were under consideration, this would be reckoned pretty bad shooting—but it was good governing.) The "hits" were duly recorded by a loud "chuff" in the basement somewhere and were

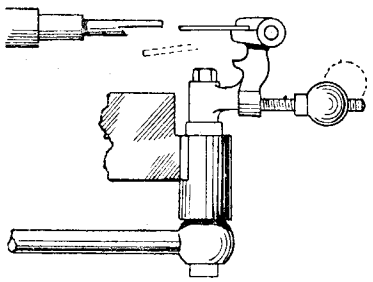


Fig. 4. Inertia governor as applied to small Crossley gas engines

accompanied by the not unpleasant odour of gas engine exhaust.

Meanwhile the two formidable flywheels continued to revolve with no apparent fluctuation of speed and other operations of the engine continued to function with a punctuality determined by valve mechanism of faultless design.

There was another interesting feature of this engine and indeed of most gas engines of the same period—*hot-tube ignition.* The tube was housed in an asbestos-lined chimney 3 in. in diameter perhaps. This chimney was usually crowned by a perforated cap or top. A bunsen burner situated at the base of the chimney provided flame which not only heated the ignition tube to a good red heat but treated the asbestos lining in like manner—this giving rise to a warm red glow within the chimney and a flickering purple flame hovering over the cap at the top of the chimney.

One regrets that such a cheerful and comforting display is no longer to be seen. As far as the gas engine is concerned tube ignition is dead. With timing device or without.

A Hot Air Engine in a Barber's Shop

Not many will remember that there was a time when up-to-date hair-cutting establishments were accustomed to use *rotary* brushes for hair brushing. These brushes were provided with two handles and a grooved pulley. There was overhead shafting with similar pulleys which when desired were capable of being coupled to any one of the brushes by means of a rubber *stretchable* belt. Thus the brush revolving at a pretty good speed could be applied to the scalp of any customer, who, whether he appreciated it or no, certainly received a thorough dusting. . . . I need hardly remark that these contrivances have not been popular since the 1914 war!

Now the hot-air engine was an ideal machine for driving these atrocities and not far distant

from Paddington Station there was one of the well known Robinson engines employed for brush work. And what a suitable form of power —safe, silent, simple and all sufficient for the purpose. (To refresh my memory on these points I recently started up the small Robinson engine in my workshop—for I had hardly recollected how silent was the action of this simple machine.) Other than connection to the gas found it difficult to resist " machinery in motion," for there was much to be seen—especially on the south side of this street. Gas engines, oil engines, air engines, all were represented and all were in motion. I am unable to make a close estimate of the number of hours I spent gazing through plate glass windows at rapidly revolving flywheels and cranks, rotating governors and cams, vibrating links and levers, flapping belts and a host of other

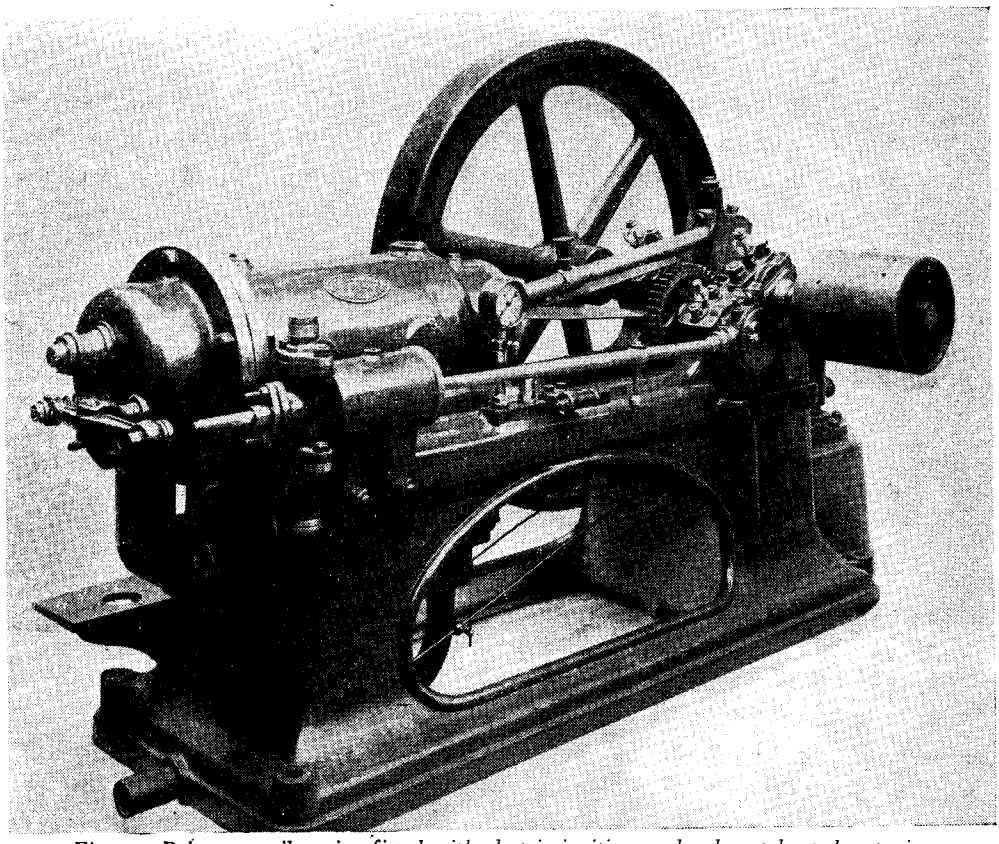


Fig. 5. Priestman oil engine fitted with electric ignition and exhaust-heated vaporiser

supply, there was needed no pipe connection neither for exhaust gas nor for cooling water. Yes indeed, those were the days when the Robinson engine was a pretty useful and convenient little machine.

It seems to have been the custom to paint all small hot air engines *dark blue* as to their cylinders and other large parts, but small links and moving levers were painted *signal red* and I think this may have been done to render conspicuous delicate parts which would otherwise have appeared altogether too fragile for the work imposed upon them. Be that as it may, red linkage was ever associated with the air engine.

Queen Victoria Street

Queen Victoria Street of the 'nineties was the happy hunting ground of those young men who attractions which my memory is just able to recall but which are too numerous to set down here. Thus it will be well to proceed with the narrative and describe some of the attractions referred to in more detail.

The Griffin Gas Engine

I well remember an engine which could be seen at work in a basement in the street just referred to. It was an unusual machine. It was double acting. Explosions took place on *both* sides of the piston and this would surely have become red-hot had not measures been taken to prevent such a calamitous state of affairs. In addition to the usual four strokes of the four-cycle, two additional strokes served to draw into the cylinder a charge of gas-free cold air and discharge this through the exhaust valve. This air had, of course, its effect

upon the piston-rod as well which would certainly have reached a very high temperature without such assistance. The double acting principle

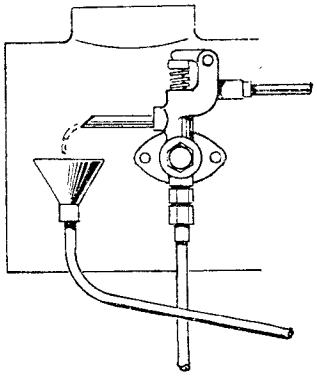


Fig. 6. Spill device fitted to Hornsby-Akroyd oil engine

applied to this engine gave it a somewhat fearsome appearance and added not a little to its overall-length, thus I have always regarded the Griffin engine as a crocodile among engines and indeed the feet at the front and rear of the engine and the lack of central support also suggested this rather unpleasant saurian. The engine exuded a good deal of exhaust gas and its ignition was by open flame—a flame could be seen flickering at either end of the cylinder and the engine revolved at a rather higher speed than was usual and there must have been an additional cam mechanism to provide the extra air for each end of the cylinder and what with one thing and another the engine seemed to be the cause of a great deal of clatter and noise of one sort and another—clash-ity—clash-ity—clash-ity—clash-ity and so on all the live long day, and since this engine was responsible for operating printing machinery—perhaps far into the night.

The Priestman Oil Engine

At the lower end of Queen Victoria Street, where it was usual for me to start upon my self-conducted tours, was to be seen a very early example of the internal combustion engine—the Priestman oil engine. The design of this engine (Fig. 5) differed not a little from accepted gas engine practice. The cylinder was mounted upon the hollow bed of the engine—it was not over-

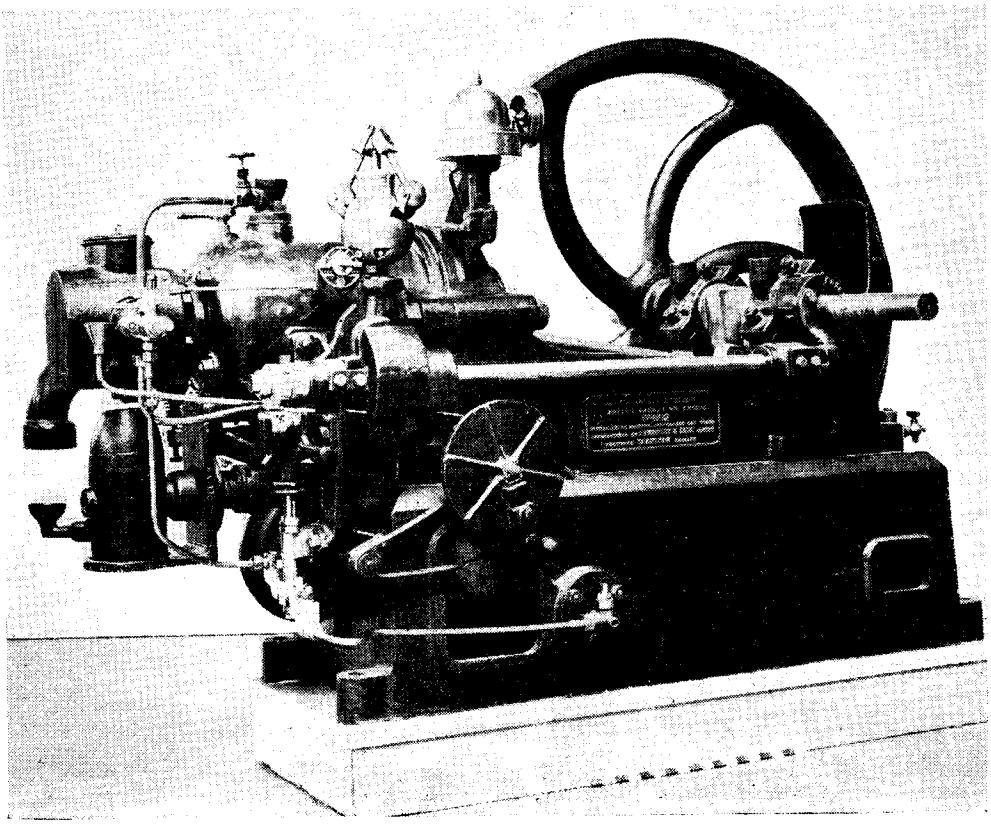


Fig. 7. Hornsby-Akroyd oil engine. Note vaporising chamber behind cylinder with lamp for preliminary heating. Ignition by hot walls of chamber. Note also belt-driven lubricator and Porter governor

hung, there was no side-shaft but spur gears were used for exhaust operation and other matters. Ignition was by electric spark, the vaporiser was exhaust heated and indeed while Priestmans of Hull lead the way no other manufacturer seemed inclined to follow. I do not know why. I think that a good few of the Priestman engines went into lighthouses where they drove air compressors used for foghorns. And indeed they served this purpose remarkably well. They could be got to work quickly before fog descended and obscured every object on sea and land. Frequently when I paid a visit to this district the Priestman engine was not at work. I do not know whether from force of habit this engine only thought it worth while to get going when there was fog in the vicinity—as there very often was, however.

This engine presented a considerable number of interesting mechanical details—a hand pump for starting mounted upon an oil tank at the front end of the base, a very small and neat centrifugal governor centrally disposed, an air pump, for normal working, a lamp and vaporiser tucked away beneath the cylinder as well as sundry cocks and pressure gauges and what not. The Priestman engine like many another good and early machine eventually suffered defeat at the hands of simpler and more up-to-date engines—e.g., the Hornsby-Ackroyd.

The Once Popular Hornsby-Ackroyd Oil Engine

Yet another of the Queen Victoria Street exhibits was this engine and a very popular one it was in the 'nineties amongst farming folk. (At the Islington Agricultural Show the Hornsby engine always collected a crowd of interested people.)

This engine was well finished and of very attractive appearance, but there was a good deal of complication—consisting of a rather large vaporiser with a lamp beneath it and a hand driven fan to provide a blast.

I am inclined to think—though I cannot verify it—that the Hornsby engine had a low maximum pressure exerted upon the piston, for the connecting rod though of good length was of light cross-section. This, however, in conjunction with a heavy curved spoke flywheel, enhanced the general appearance of the engine, as did a belt driven lubricator perched high on the cylinder front as well as a Porter governor perched a little lower.

There were several other interesting features—from an onlookers point of view. There was a cam-driven fuel pump which pumped oil into the atomiser or sprayer via a copper pipe. Combined with the sprayer was a " spill " valve (Fig. 6) and the governor had complete control over this valve, so that when the engine was running at, say, half-load a few drops of oil would, at each pump stroke, be spilled into a cone-shaped receptacle for return, by gravity to the main oil tank. One could watch this interesting process taking place for quite a long time, before again turning one's attentions to a shapely connecting rod and crank—each following a completely controlled motion and each dependent upon the other. (My opinion is that the varying relative angles of crank and connecting-rod on any engine whatsoever present a picture of great fascination to any engineer of old time interest and experience.)

An illustration, which shows most of the details described appears in Fig. 7.

A Ryder Hot Air Pumping Engine

At a point where Queen Victoria Street joins Cannon Street there used to be a small showroom occupied by Messrs. Haywood, Tyler & Co. I do not know who the present occupier is. I do not even know whether this building still stands. But I *do* know that in the 'nineties the showroom housed a hot air engine of unusual design and construction—a Ryder engine. A peculiar machine and unlike any other with which I am acquainted.

It possessed two large vertical cylinders, each fitted with a trunk piston and each coupled to an overhead crank by a built up connecting rod. A flywheel occupied a position betwixt and between them. Now there is a curious feature to be remarked upon. The pistons had *no* piston *rings*. Nor did they rely upon " fit " for pressure tightness. They had instead *leather* packing rings (? hat leather) and I believe some special kind of grease or fat was considered necessary to maintain the leather in workable condition.

The engine was conspicuously free from gadgets—two pistons, two cranks and two con-rods plus one flywheel—and that was all. But I must not omit to mention a pump, driven by one of the pistons and not only supplying cold water for cooling the engine, which had a water jacket, but in addition supplying water for the use of a neighbouring mansion, country house, farm, or other building—and indeed a number of these simple and easily handled little machines found their way into country districts in connection with water supply—but for no other purpose, I think.

The fuel used for this engine was coke, fed into a small furnace, with fire door and flue, situated beneath one of the cylinders and suggesting, perhaps, a steam engine. When closing down at night the Ryder air engine took some considerable time to cool down and eventually came to a standstill—the speed becoming very low before this state of affairs took place. I can remember on a number of occasions watching the process.

A Robey Engine in a Chocolate Shop

In Gower Street, a few minutes walk from University College, dwelt a well-known maker of chocolate, and the machinery common to his particular trade was kept in motion by a robust little Robey gas engine which I should judge to have developed about 5 or 6 h.p. The design of this engine was characteristic of the period—though it may have had a rather shorter stroke than was usual—in proportion to cylinder bore. The engine displayed a solid looking hollow iron bed, swept outwards at floor level to provide stability—and an overhanging cylinder. There was by the way an unusual feature in regard to the connecting rod. The " big end " was similar in design to the rod-end of a traction engine on " portable." (Fig. 8.) The ignition tube (Fig. 9), in its asbestos lined chimney, was secured to the back of the cylinder and sloped towards the back of the engine—the arrangement

being such as to permit adjustment of the incandescent portion of the tube and thus to time the moment of ignition without the need for any special timing valve. This was quite a usual method in the past and worked sufficiently well. Hit and miss governing was controlled, to the best of my recollection, by a small ball governor and as the silencer was located apparently only a few feet below the floor of the engine room one could

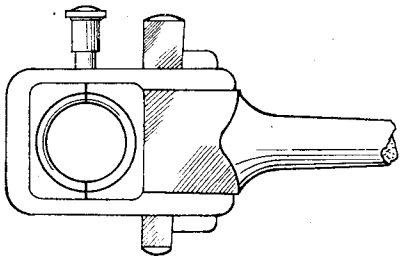


Fig. 8. 'Type of "big-end" fitted to old-time Robey gas engine

appreciate the working of the governor by the sound of the exhaust discharge—chuff-chuff—chuff—chuff-chuff-chuff—and so on. And when one entered the shop either to purchase chocolates or to have a peep at the engine—or both, one was assailed by an agreeable aroma—a mixture of chocolate, gas, hot metal and exhaust, seemingly blended with the same skill as were the "fillings" of the chocolates themselves. (The gas engine was nearly always associated with an agreeable atmosphere—at least this was my experience.) This gas engine left the Gower Street vicinity many years since. Alas!

A Few More Old-Time Gas Engines

I do not find it an easy matter to recall other old-time engines, in any case none such as were open to the inspection of the dwellers in London of the 'nineties. But that there were other engines in existence at this period is beyond doubt. Let me mention a few—the National, the Stockport, the Dawson, the Ruston, the Midland, the Fielding—there are half a dozen for you and I feel confident that certain of the early readers of THE MODEL ENGINEER could, if they would, add a few more names to the list.

It may well be that examples of the three first mentioned could be seen in the flesh. The Dawson, recently well described in these columns by another writer, was, I think, on view in Queen Victoria Street—and it suggested the idea that it would constitute first class material for the model-maker, so simple did it *seem*. Actually there were parts concealed in the anatomy of the machine which would have proved a stumbling block to many a model enthusiast.

Perhaps there was a Stockport or a Campbell engine—with its secondary charging cylinder—somewhere in the Metropolis. There was one—a Stockport—I remember, at Brighton providing current for Volk's electric railway of early days. I imagine there must have been one of these interesting engines in or near town, for I so well remember its charging cylinder and the piston worked by a connecting rod from a crankpin fixed to a spoke of one of the flywheels, a substantial exhaust outlet of rectangular section near the forward end of the working cylinder, hot tube ignition apparatus, a ratchet driven lubricator and so on and so on. . . . It has just occurred to me that I have been describing a Campbell engine that

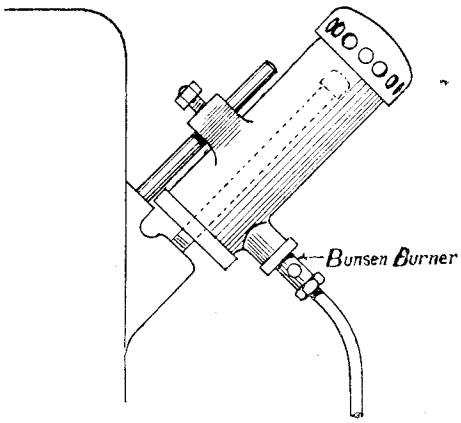


Fig. 9. Tube ignition as applied to Robey and other engines

was undoubtedly exhibited at the Crystal Palace in 1892, and this was the year in which seeds were sown which have, in due time, blossomed forth into this somewhat reminiscent and rambling record.

LATHE LUBRICATION

On the back cover of the May 10th issue of THE MODEL ENGINEER, Messrs. Myford had an advertisement concerning lubrication of the M.L.7. They now fit nipples in place of the spring-ball oilers of earlier models. It is, however, quite easy to have pressure-lubrication using these oilers. I bought a Tecalemit "Visi-gun," made, I believe, for cycles, and fitted a new nose with a male 5/64 in. radius end and a No. 53 through hole. The new nose was soft-soldered on to the original brass cup-end.

This certainly gives pressure-lubrication. Two or three pushes on the saddle-oiler cause oil to be forced out from under the saddle, and, of course, any swarf with it. Any gun that will pump oil could be converted, but the "Visi-gun" is most suitable, being only about 3 in. long and 1 in. diameter, with a transparent plastic body. I keep mine in a Terry clip on the right-hand side of the mandrel belt guard.—F. G. GARRAWAY.

HE WOULD BE AN ENGINEER

by "Base Circle"

RECENTLY, when turning out some very old papers with a view to helping the salvage effort, I came across a tattered old notebook which, I found, contained among other things some sketches of an electric motor of a very elementary type, and some crude drawings of a very simple lathe. This find recalled to me my early essays in engineering, for the motor must have been about my first successful working model, while the lathe, crude as it was, was actually made and did some quite good work. It occurred to me then, that an account of the early struggles of a very enthusiastic but very hard-up would-be mechanic might be of some interest and might even serve as encouragement to other equally impecunious aspirants to the gentle art of engineering.

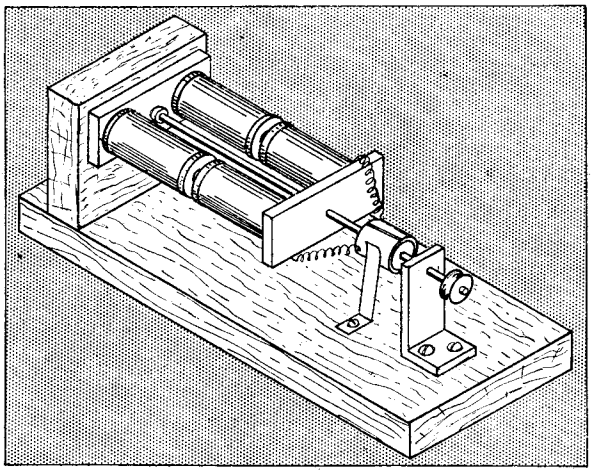


Fig. 1. *The electric motor*

I can't remember when I first began to take an interest in things mechanical, but it must have been at a very early age for, looking back, it seems that I have always been trying with more or less success to make something or other—usually with most unsuitable material and, for many years, without proper tools. Where this urge to make things came from I can't explain, for I was brought up in the country far away from all engineering associations, and I certainly got little encouragement; on the contrary, I was given to understand that I could consider myself lucky that my time-wasting efforts were tolerated at all!

I think I must have been about ten or eleven years old when somebody gave me a present of a set of fretworking tools on a card. I immediately set to, of course, and used up all the wood I could lay hands on producing some of the floridly designed brackets and boxes which were the fashion in those days. These monstrosities were very popular with my friends and relatives, and I acquired quite a reputation for this kind of work; but somehow I could never work up any enthusiasm for woodwork of any kind and my interest in fretwork soon evaporated, though from time to time I had to placate my relatives by producing an odd glove-box or picture frame.

I found, however, that some of the fretworking tools could be used for purposes other than those for which they were intended. The saw, for example, could be used to cut metal, and before long I found that special blades for metal-cutting could be obtained. The Archimedian drill, too, I found, could with an effort be persuaded to make holes in odd bits of brass or steel. About this time I got a copy of Hobbies' catalogue and this taught me quite a lot, apart altogether from fretwork.

It wasn't, however, until I found in the public library of the nearby town a book by S. R. Bottone that I made any real progress in engineering. This book proved an absolute treasure to me. I used to take it out regularly every fortnight—carefully renewing it before any fine was incurred. For the first time, I had some guidance in my hobby and I read that book from beginning to end over and over again. There was one chapter describing the construction of an electric motor, and soon I decided that I would build one.

Now, although Mr. Bottone went into great detail about the construction of the various pieces of apparatus he described, he still assumed that his readers had some electrical and mechanical knowledge, and I'm afraid I had little, if any, with the result that I made many blunders. Still, it is by mistakes we learn, and I certainly learned a lot before that motor was finished.

The isometric sketch (Fig. 1) which I have prepared from the original sketches in that old notebook shows roughly what the motor was like. Well, the job was started, but soon lack of equipment necessitated departures from Mr. Bottone's instructions. For example, the pole pieces were supposed to be turned down and forced into reamed holes in the yoke pieces. Of course, turning was out of the question, and even the drilling of holes of this size would have been very difficult, so I cheerfully proceeded to *solder* the pole pieces to the yoke; soldering

was one thing I had learned from the catalogue!

Next, I proceeded to the nearest town to buy D.C.C. wire as specified in the book. I, of course, had no idea what the wire should look like, so that it was quite easy for the shop assistant to fob me off with what later I learned to be ordinary bell wire, with the bland assurance that it was the very thing for winding motors. The result was that I didn't get nearly enough turns on the

In addition to this help, my new friend introduced me to THE MODEL ENGINEER, which I have read ever since, and have always found a constant source of help and inspiration.

At that time, however, I found the advertisement pages almost as helpful as the magazine itself. I found the proper places to get tools and material—the only difficulty was the old one—lack of money. Nevertheless, I soon had all

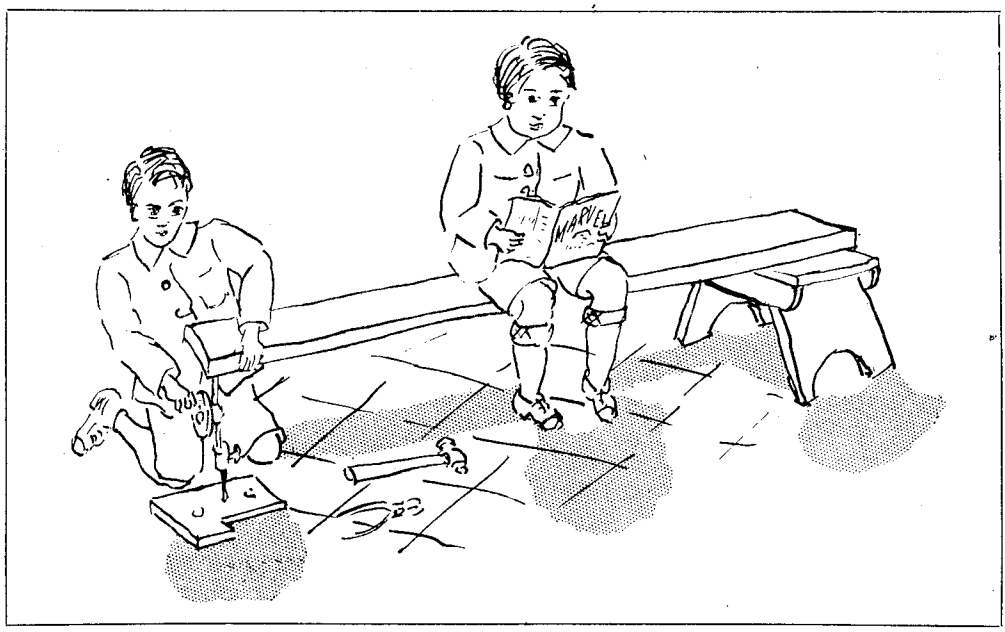


Fig. 2. A "sensitive" drill

magnets. Anyway, after a bit of a struggle with the commutator—made out of a piece of wood with a length of brass tubing driven on—which obstinately refused to run true, the motor was finished, complete with the rather optimistic driving pulley. Mr. Bottone's book assured me that one dry cell would drive it, so I bought a bell cell. Alas, the motor showed no sign of life, and even after repeated adjustments and the fitting of a slightly better commutator, it still remained absolutely and completely dead.

I persevered with it for weeks, trying everything I could think of—even making up a pair of bichromate cells—but all to no purpose. However, just at this time I made the acquaintance of an electrical engineer who was installing generating plant in a new colliery which was being opened nearby, and when I showed him the motor he soon diagnosed the trouble. New magnets were, with his help, made. This time there were no soldered joints and the correct wire was used, and when my two dry cells were coupled up there were immediate signs of life. Soon the armature was spinning round merrily to the amazement of all my friends—though it never ran freely enough to be driven by the *one* dry cell called for in the book.

sorts of catalogues; they at least were, at that time, usually supplied gratis. The favourite catalogue of all was George Adams's. What a mine of information it was, and what a wonderful firm it was to deal with. Even my little twopence-halfpenny orders were attended to with the utmost care and attention. They never jibbed at supplying, say, 3 sq. in. of $\frac{1}{16}$-in. sheet brass or 6 in. of $\frac{1}{4}$-in. brass rod. If, by chance, I sent too much to cover my order (this, I can assure you, didn't often happen) they gravely credited the excess to my account. I well remember one case where the amount involved was the vast sum of one halfpenny!

Before getting the G.A. catalogue, I had been foolish enough to buy a breast drill—at a cost of 7s. 6d.—in the nearby town. It was a most exasperating implement. It could drill holes all-right, but it had no chuck; the drills merely fitted into a $\frac{5}{16}$ in. hole in the end of the spindle and were held by a thumb-screw. The result was that all my drills had to have $\frac{5}{16}$ in. shanks. Fortunately, seven drills were supplied with the machine—flat forged drills, and later I got from George Adams a set of flat drills with $\frac{3}{16}$ in. dia. shanks. These were adapted by wrapping the shanks with tin to bring them up to the

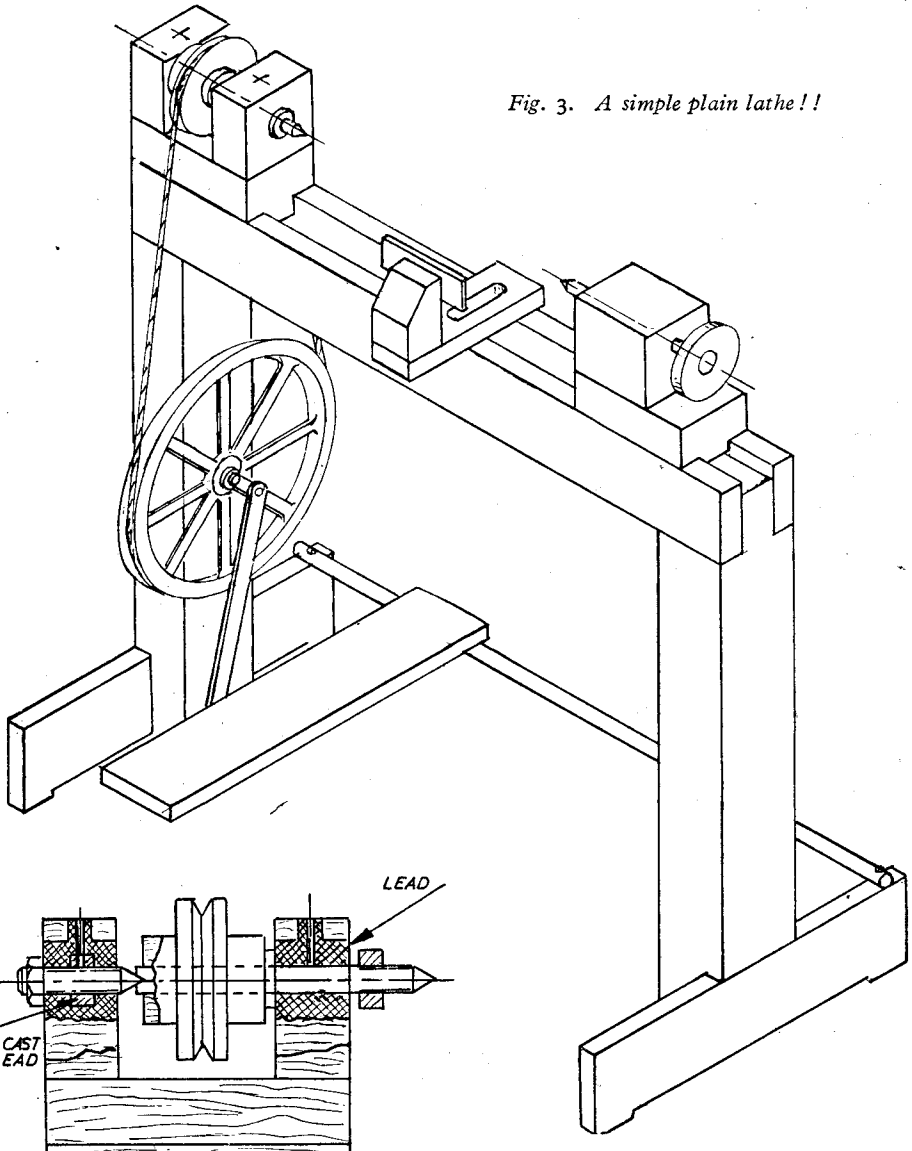
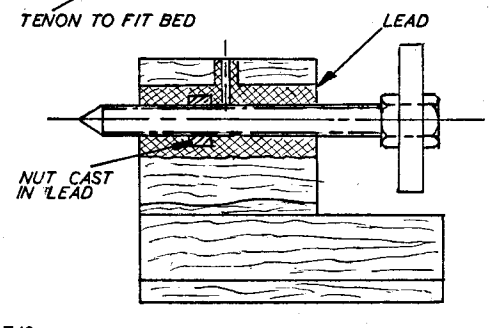


Fig. 3. A simple plain lathe!!



Left—Fig. 4. Head- and tail-stocks

necessary $\frac{5}{16}$ in. dia. For the bigger holes, the greatest difficulty was to get sufficient pressure on the drill. Up to about $\frac{3}{16}$ in. it was possible, but over that it was too difficult. The sketch (Fig. 2) shows more clearly than words can explain how this difficulty was overcome. So long as I kept up the supply of "bloods" (the *Marvel*, I remember, was his favourite) my little cousin, who happened to be nice and plump, was quite content to sit on the plank. The pressure on the drill was adjusted by moving him nearer to or further away from the stool.

My next purchase was a 3-in. " Handy " vice and with it and my drill—in spite of its drawbacks —I became quite bold, making attempts at built-up steam engines and much more elaborate electric motors. Before long, of course, like every other amateur engineer, I felt the need of a lathe. To buy one was out of the question but that

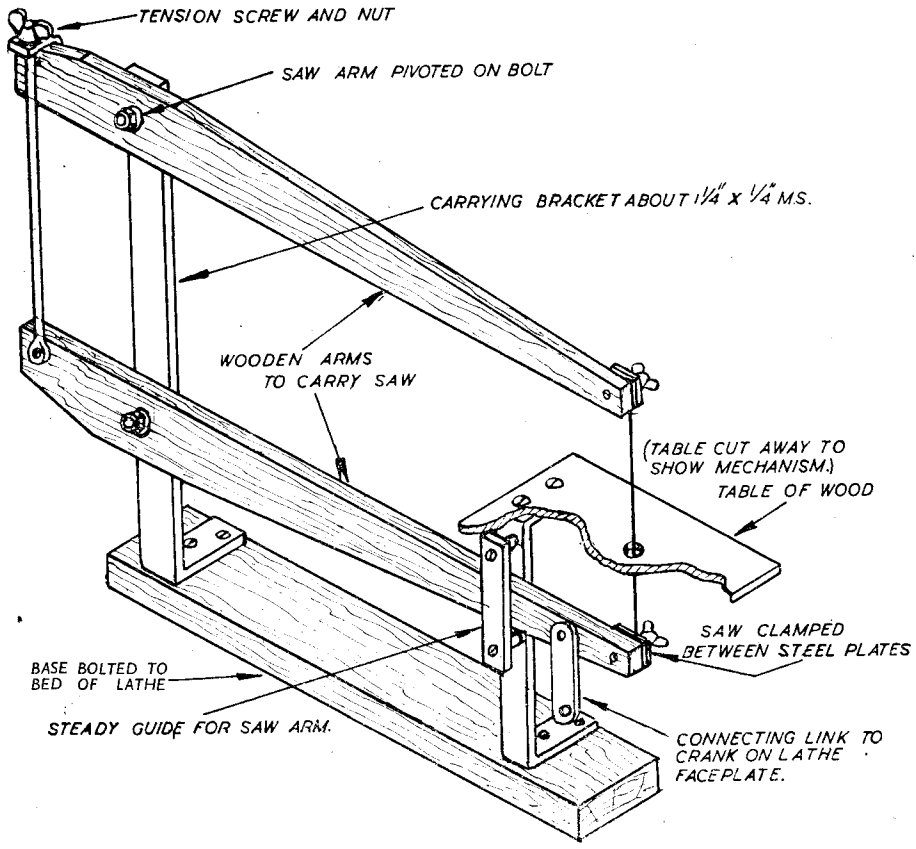


Fig. 5. Fretsaw attachment for lathe

didn't stop me from getting catalogues from all the likely makers—Drummond, Relmac, Patrick are among the names I can still recall.

Well, if I wanted a lathe it seemed that the only way to get one was to make it, and that is just what I set out to do. Fig. 3 gives a good general idea of the machine (!) eventually produced. For me, with the tools available, wood was the only possible material. The machine, as will be apparent, was as simple as it could be, but even so its construction raised many problems.

The bed and stand consisted of two pieces of 4 in. × ⅝ in. stuff bolted to the uprights—two fencing posts got from an obliging farmer—with cross-pieces of the same 4 in. × ⅝ in. material to form the feet. Various struts and stays, not shown on the sketch, were added later to stiffen the whole thing up. The head- and tailstock were also of wood built up as shown in Fig. 4. The bearings were of lead cast into the wood. In the case of the rear bearing for the headstock spindle, an ordinary nut was cast in the lead—I must have had qualms about the durability of a thread in the lead alone. The same procedure was followed in the tailstock. One of the greatest difficulties was that I possessed no screwing tackle of any kind, so that everything had to be built around material already screwed. The mandrel, for example, was a long ½-in. bolt with the head cut off. The shoulder on the nose was provided by jamming a nut up to the end of the thread and facing and turning it after the machine was finished. The tailstock barrel was a long piece of ½-in. screwed bar pointed at one end and with a wheel from a child's toy as a hand-wheel locked between two nuts. While the lead was being poured, the spindles were located by tinplate washers tacked on to the wood. These lead bearings served their purpose quite well for several years—indeed, until the machine was discarded—and, probably because the holes through the wood were very rough, they never

gave any trouble through becoming slack in the wood.

The driving wheel was obtained from Messrs. Hobbies for a few shillings. It drove a wooden pulley on the mandrel. The hand-rest and treadle motion were comparatively easy jobs, and very soon the machine was complete and ready for trial. Well, crude as it was, the lathe was quite successful and, after the flywheel had been weighted with a piece of lead pipe bent round and tied firmly in place, it was found that brass and even steel, if not too large, could be turned quite easily. The tools were old files, softened, filed to shape, and rehardened. Wood turning was quite simple and I was able to get into the good graces of the domestic authorities by producing all sorts of articles such as knife handles, rolling pins, potato mashers, etc., from odd bits of wood. I well remember that the first rolling pin was not approved at all ; I had turned it from an old mahogany chair leg and seemingly such articles had to be in white wood.

Later on I manged to make a chuck for the lathe with a $\frac{5}{16}$ in. hole to suit my drills, and with this addition the machine became quite a useful drill.

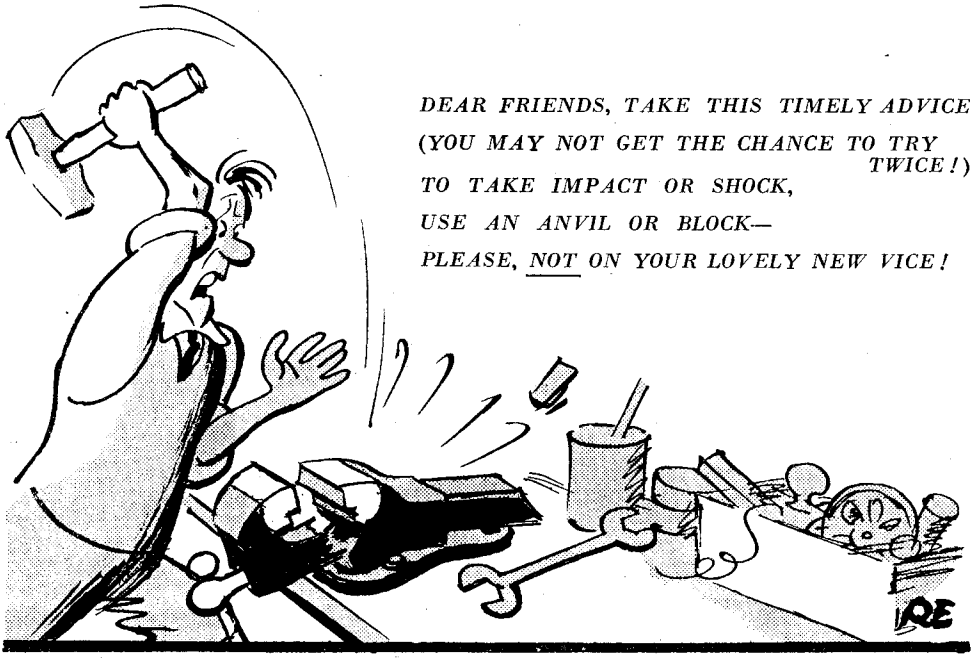
All this time I was still in demand as a fretworker, producing wall-brackets and flower pots for church bazaars and sales of work, but I grudged the time I had to spend on this kind of thing and I determined to speed it up by making a fretworking attachment for my lathe. This was quite a simple job with Hobbies' catalogue to refer to for inspiration, and soon I had quite a serviceable machine rigged up. Fig. 5 shows the simple, but quite effective, construction. My fretworking output was now about doubled, but I fear that the design and construction of the machine gave me far more pleasure than I ever had in using it. At the same time a fretworking attachment for a lathe is such a useful thing that I often wonder why so few amateur engineers possess one.

Well, that rough-and-ready lathe with its fretworking attachment served me faithfully for several years ; indeed, until I left home to learn to be a real engineer.

Looking back, I think I can safely say that I learned more about practical engineering from the pages of THE MODEL ENGINEER and from my own clumsy efforts than I did during the whole course of my apprenticeship. In fact, when I first went into the shop, it seemed to me that with the beautiful precision machines available, machining became almost too easy to be interesting !

Whimsical Workshop Warnings

by Rick Elmes



For Delivery on December 25th

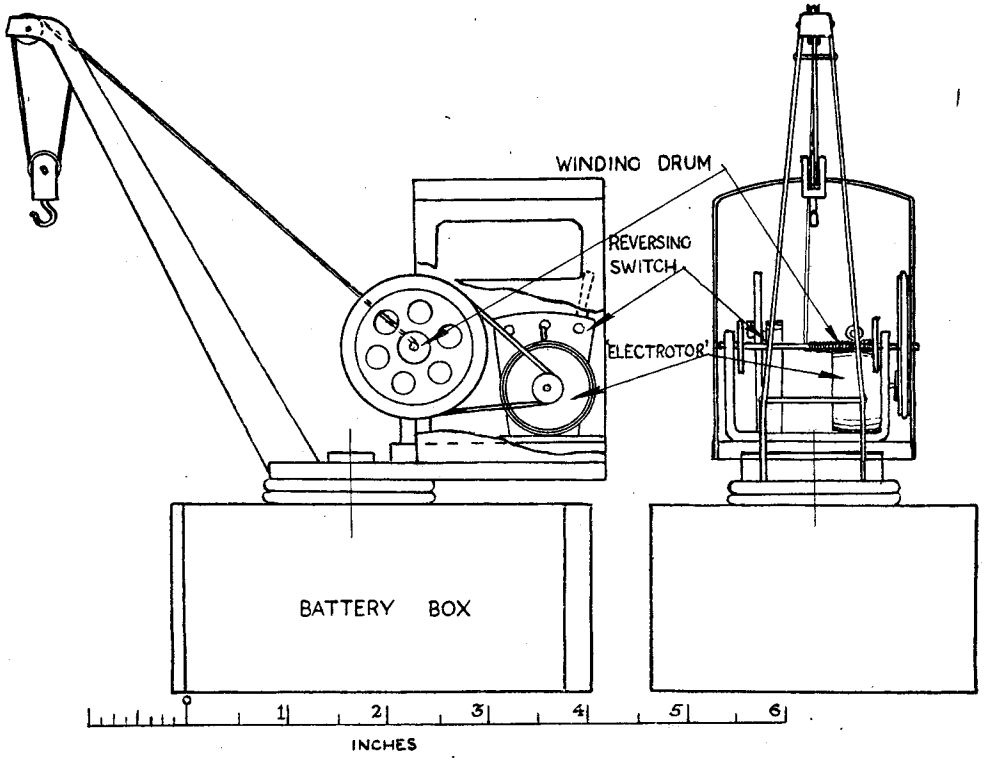
A Suggestion for the Christmas Stocking

by F.M.

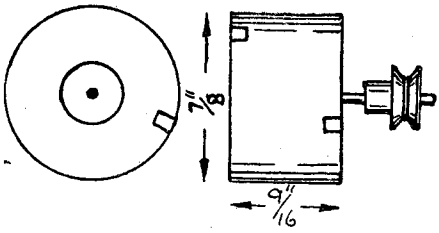
RECALLING frantic expedients in the past to dry out the paint in time for Christmas morning, I do not think the present a bit too early to make a start on Christmas gifts for sons or nephews. This little electric crane was made three years ago, and is now almost as popular as it was when new ; I offer it as a suggestion to those who have a boy between the ages of 8 and 12 to think about.

The battery box was made to internal dimensions of $3\frac{5}{8}$ in. × $2\frac{3}{4}$ in. × $1\frac{3}{8}$ in., to fit a " twin-cell " cycle lamp battery. Brass strips were screwed in the appropriate places to make contact with the battery. One contact was earthed to a steel washer screwed to the top of the box, and the other connected by an insulated wire through a hollow pin screwed in the centre of the washer to the switch. This method requires stops to prevent the crane making a complete revolution on the pivot pin ; a better method would be to connect to a circle of brass screwed to the top of the box, then connecting to the switch *via* a spring contact in an insulated bush in the base of the crane.

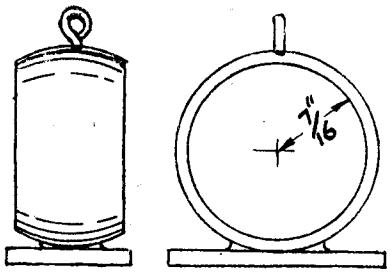
A second washer was made to fit the pivot pin, and was screwed to two $\frac{3}{16}$-in. mild-steel longitudinals, screwed in turn to a piece of $\frac{3}{16}$-in. mild-steel carrying the " works." The winding drum is a length of bicycle spoke carried in bearings bent up from $\frac{1}{2}$ in. × $\frac{1}{8}$ in. brass. Discs to prevent the " rope " fouling the bearings were sweated on after assembly, and also a $1\frac{1}{2}$-in. pulley. The reversing switch was cut from ebonite and drilled and tapped 4 B.A. for the contact studs. Note that the bar connecting the two arms is made from ebonite. The switch was fixed vertically by 4-B.A. countersunk screws through the base.



General arrangement of the model electric crane

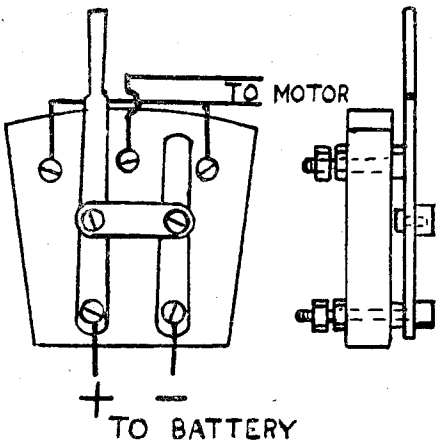


The electromotor



The base and ring to improve appearance

If the crane is to function as a self-contained unit, the motor must be an " Electrotor," as the ordinary small motor is too heavy on juice to be an economical proposition for use with a dry



The reversing switch and connections

battery. The Electrotor is made on different principles, and its current consumption is as diminutive as its size. The " casing " shown in the drawing was turned from brass tube, sweated to the baseplate, and a lifting hook fitted, to improve appearance.

The jib was bent and filed to shape and fastened to the ends of the square section longitudinals with 4-B.A. screws. To avoid twisting of the line in operation, the pin to which the end is fastened is placed some distance away from the pulley-centre. The pulley block may, of course, be eliminated altogether, but, by an inexorable natural law, the weight which can be lifted will be halved. The maximum load, incidentally, is 4 oz., using an ordinary twin-cell battery. The pulley-block was made from a bit of $\frac{1}{2}$ in. $\times$ $\frac{1}{4}$ in. mild-steel, and is as shown in the general arrangement. It would be better with a thicker pulley with deeper groove and a heavier block. The line running off that thin pulley is a frequent cause of juvenile exasperation. The " cab " is cut from tinplate and screwed to the edges of the baseplate.

The driving belt is a thin elastic band, as sold in bundles in stationery shops. With such a minute amount of power, the tension must be " just so," and to obtain this, a tight band can be " over-stretched " until it is the correct size. I found a fine, strong, soft line on the fishing-gear counter at Woolworths. And as to finish, it may be " correct " to paint in the drab colours so often used for industrial machinery, but with children it is the bright red and yellow that attracts.

The Benefit of a Hobby

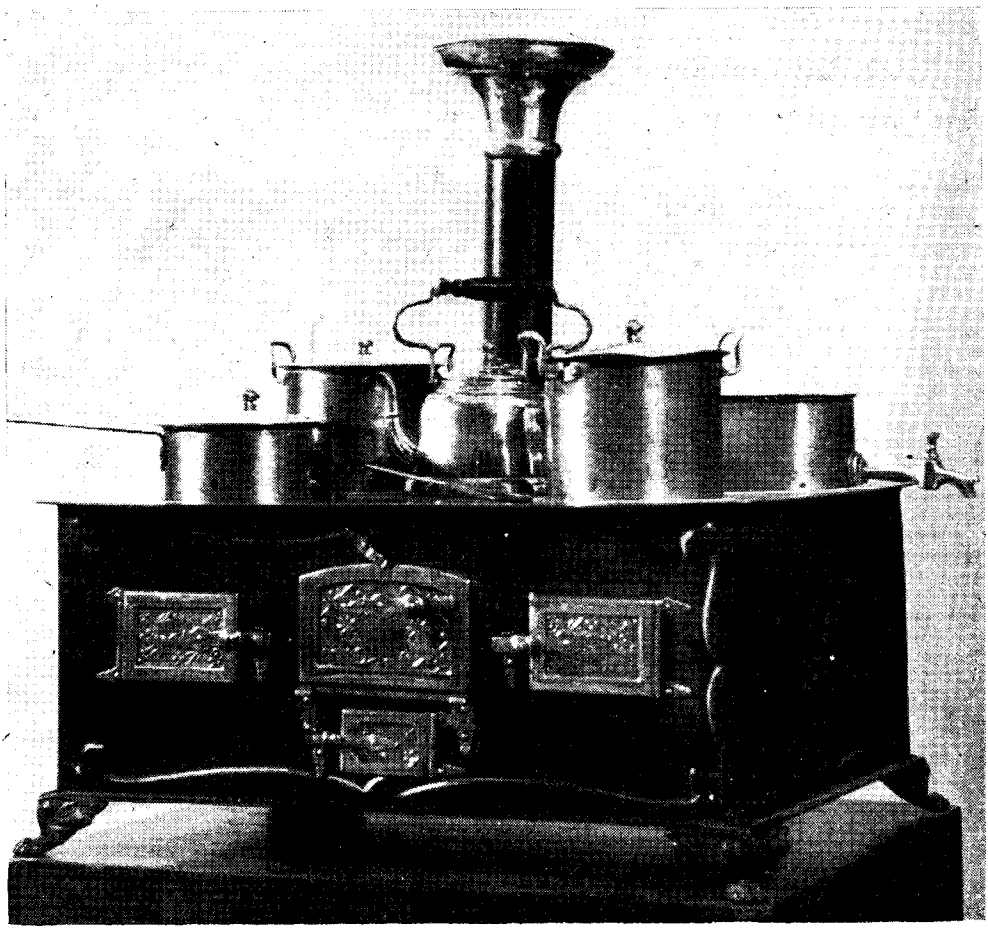
We were sorry to learn from a letter we have received from Mr. A. J. Cannon, of Stanger, Natal, that his father died last July. Mr. Cannon senior was a retired engine-driver, one of the old school, who understood locomotives in theory and practice ; he was also a keen model engineer and a very great admirer of " L.B.S.C." He and his work were referred to by " Professor " W. E. Maddock in an article published in THE MODEL ENGINEER for March 28th, 1935. His son writes : " When I was four years of age, he started teaching me, and now, forty years later, he has gone, and this closes a wonderful relationship. Besides being father and son, we were great friends and always discussed our engineering problems together.

" We were bitten by the ' radio virus ' about the year 1926, and having been through that by the time he retired in 1930, we set up a new workshop at Hillary and started again on model engineering. About this time, I was transferred 50 miles away from home, but have always managed to keep in very close touch . . .

" During recent years, my father's health was very poor, but until Christmas, he was still actively engaged in his workshop.

" . . . Arising from all this, I would like to pay a tribute to model engineering generally. I am *absolutely convinced* that it was through having an absorbing hobby that my father lived to enjoy twenty years of happy retirement."

We have no doubt about the truth of the last statement ; we have mentioned it before, and we know of innumerable instances of the same thing, and Mr. Cannon's example is another to prove its truth.



A MODEL COOKING STOVE

NOT long ago, I saw a neighbour's children playing with an excellent model cooking stove. The general finish was so good that I borrowed it for a close examination. It is definitely a working model and not a toy. All the fittings needed to cook a meal are included, even to the oven shelves, the fire iron and removable, annular, hot plates of the usual pattern.

The bottom centre door and the two wing doors appear to be the firing doors, but there are no signs of any firebars, etc., having been fitted. The bottom plate of the model is drilled for air holes, so it was probably fired by a spirit burner. The oven door opens downwards and holds itself in the horizontal position, allowing the very long oven shelf to be drawn out by the fire iron. All the doors and hinges are of sheet brass and are richly ornamented with a raised, geometrical pattern.

The stove is made of thin sheet steel, enamelled and gold-lined with the usual designs found on old cast-iron stoves simulated by a raised pattern. The top is of polished steel with four recessed circular holes for the pots and one hole of rectangular shape with semicircular ends to take the hot water boiler. The pots and the boiler have beaten brass lids all tinned on the inside. The brass handles are riveted on in the correct manner. A handsome brass kettle completes the list of utensils ; it is tinned on the inside and fit to use.

The funnel is rolled from sheet steel and riveted. The trumpet-shaped canopy of brass does not appear practical unless the stove was intended to work under an exhaust canopy.

The pots and the boiler have flanges under their bottoms to fit the holes in the stove top to prevent them sliding, so perhaps this is a model of a ships galley. The only information I can get is that it came from America a long time ago.

The overall dimensions are : 14 in. by 10 in. by $6\frac{1}{2}$ in. high. The funnel is $9\frac{1}{4}$ in. high by $1\frac{3}{8}$ in. diameter.—F. TALLACK.

Works Outing —— A Railway Ghost Story

by "L.B.S.C."

(Illustrated by P. Evans)

IT was a glorious morning in the late spring of 1984. The human race had come to its senses, banished bloodshed and destruction for ever, and was devoting all its energies into making the world a grand place to live in. The sun shone brightly on the busy streets of Ashford, as the good folk employed at the SouthernRailway works made their way thither, many in their own cars, others by bus, cycle, or afoot. In their unpretentious but comfortable home on the outskirts of the town, the Chief Mechanical Engineer, Sir Roy Donalot, and his wife Lady Vera were just about to sit down to breakfast, when the door bell rang; and a minute later, their adopted daughter Julia, an attractive girl of 17, entered the room with some letters, which she handed to Lady Vera. Julia's father, a signal inspector, had been killed on duty some three years previously; her mother had only survived the shock by a couple of months. The Donalots, feeling lonely as the years were rolling on, promptly adopted the orphan girl; she had become devoted to them, and had proved an invaluable help to Lady Vera in the house.

"Thank you, dear," said Lady Vera. "Sit down, we're just starting." She poured out the coffee, and they all got busy on the new-laid eggs and home-cured bacon. Whilst waiting for her second cup of coffee to cool off, Lady Vera glanced through the envelopes. "Rosa, the gas bill, Swan and Edgar's receipt, and—hullo, Roy, one for you from the G.M. What have you been up to now?" she said with a smile, passing the letter over. Sir Roy paused in his attack on the toast and marmalade, and replied: "Me? why, nothing at all!" "Maybe that's why he sent," said Lady Vera, with a wink at Julia.

Sir Roy slit the envelope and extracted two papers. The first was a company memo. form, headed "Southern Railway, General Manager's Office, Waterloo Station," and bore this message:

"Dear Roy—Enclosed to hand this morning, from Robin Hood's Mrs. It explains itself. Will you get in touch with your female throttle-jerker as soon as possible, and if she's agreeable, ring me during the morning. Another smashing advt. for the Southern! Excuse haste, just going to lunch with old Brummy the chairman, so cheerio in anelovanurry—Yours, Syd."

The enclosure was as follows:

Railway Carriage Accessories Ltd.,
Jubilee Works,
Middlesex.

Ref. MH/JC, May 30th, 1984.

General Manager, Southern Railway,
Waterloo Station, S.E.1.

Dear Sir Sydney,

As July 6th is not only the date fixed for our annual outing, but completes 25 years of cordial business relations with the Southern Railway, our directors would like to celebrate the occasion by hiring an *extra* special train of Pullman cars, and one of your latest engines, for the trip to Bournemouth. There will be approximately 500 girls in the party; and as a special favour, they are asking if it is possible for the lady train crew, who created such a sensation with the "Golden Arrow" last December, to work the train. If so, we would be honoured to have them as our guests at the luncheon at the Grand Hotel. With all best wishes.

Very truly yours,
(for R.C.A. Ltd.) Marian Hood,
(*Secretary*)

"This looks like being Joy's day out," said Sir Roy, passing the letters to Lady Vera. "Let's see, now—500 girls means 18 Pullmans, and they'd need a *Queen* class engine, anyhow, to run that lot down in the 80-minute timing."

"Can Joy drive a *Queen*?" asked Lady Vera.

"You bet," replied Sir Roy. "Inspector Mills was away with the 'flu on the day *Queen Mabel* ran her final trial before painting, nobody else was available, and Joy offered to do the recording; you know she's hot stuff at data sheets. Coming back, she took the regulator for 50 miles or so, and Johnny Barlow said she handled the engine a darn sight better than he did himself—and Johnny's no flatterer!"

"In that case," said Lady Vera. "Joy'll certainly enjoy the trip," and joined in Julia's merry laugh at the inadvertent pun.

The "Skirts" Agree

Breakfast over, Sir Roy drove his Morris down to the works, and asked his secretary to get his daughter on the telephone. When Joy's voice came through the loudspeaker, he read out the letter from the R.C.A. and asked her: "Well, Joy, what about it?"

"Just my cup of tea, dad," replied the lady engine-driver. "Can I have *Queen Mabel*?" "Certainly," said her father. "Now listen—do you know the road well enough to run the train down in the 80-min. timing?"

"Sure thing," replied Joy." I wasn't quite sure of the western end of the Southampton loop, but I got it pat on that trial run. Here is the sequence of signals, both ways," and she gave them without the least hesitation.

"O.K." said Sir Roy. "If you'll ring your accomplices, and they are agreeable, ring me back here as soon as you can, so that I can let the G.M. know right away." Joy said, "All sereny, dad," and rang off.

Company business kept Sir Roy and his

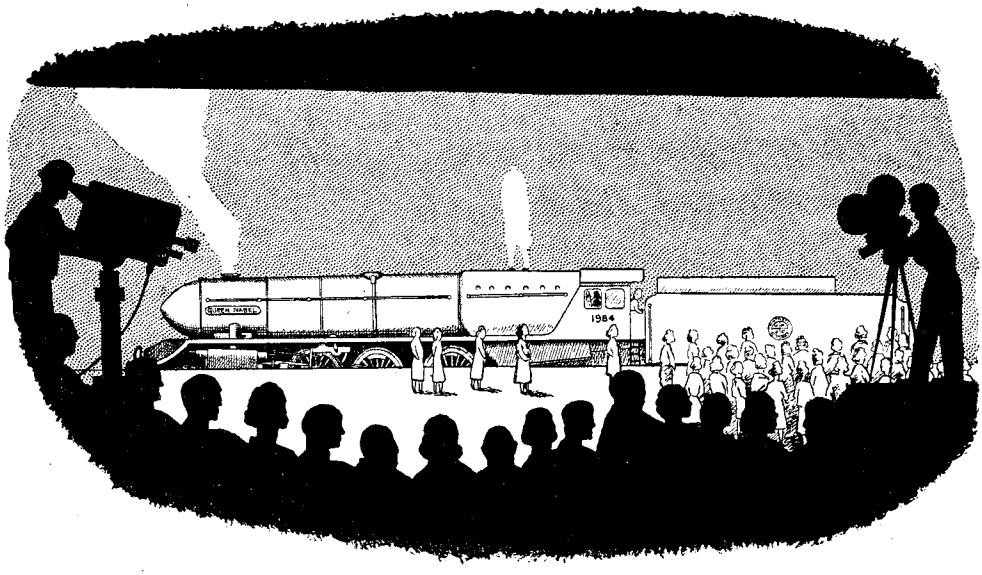
secretary busy for the next half hour or so ; then the telephone rang again, and Joy's voice came through the speaker. " That you, dad ? " she said. " It's all right, Alice, Gert and Daisy are tickled to death. There's just one point ; Alice says she'd like a run on a *Queen* with Johnny Barlow and Pat Clancey, so that Pat can put her wise to the latest type of stoker and injectors. Also, she's got a bit of green overall material, and wants to see if it matches the colour of the engines, as if so, she says she'll run us up a couple of swell overalls for the occasion."

" Dear-oh-dear," said Sir Roy in mock despair, with a grin at the secretary. " Women first, engine crew also-ran ! All right, tell Alice I'll send her an engine pass right away, and Johnny and Pat's turns of duty for the next ten days, so she can suit her own time and convenience. Now, is there anything else before I telephone Waterloo ? "

Joy laughed merrily. " Just tell Sir Syd that our last run was a sensation, but this time it's going to be a riot ! Bye-bye, dad," she said, and rang off. Sir Roy immediately rang Waterloo, told the G.M. that everything was O.K. and that worthy promptly informed Mrs. Hood, who passed on the news to the delighted girls of the R.C.A. works. In less than an hour, thanks to the switchboard girls at Ashford and Waterloo, it was known all over the line, that the lady train crew were going to run the R.C.A. " beano." Advertising manager Page passed on the news to the Press, television, and newsreel companies ; nothing likely to be of advertising value ever slipped the genial A.M. ! When they heard the news in the Eastleigh paintshop, they put all their efforts into decorating *Queen Mabel* in a manner worthy of the occasion. The Pullman Company came up to scratch by allotting 18 of their latest and most luxurious cars for the train, complete with hostesses, and extra stewardesses for the buffet car. Royalty could not have been provided with a finer turnout.

The Scene at Waterloo

The great day dawned bright and fine ; and never in the whole history of Waterloo Station, had one train attracted such a crowd. The Metropolitan Bus Company had brought the girls from the R.C.A. works in a dozen double-deckers, and a merry crowd they were, in all kinds of gay summery attire. What with friends and relations who had come to see them off, press photographers, film camera and television men, reporters and so on, the long platform was packed. The two lady guards, Gert and Daisy had already taken charge of the train, and were checking up with the Pullman hostesses ; they wore the same uniforms as on the " Golden Arrow " trip, viz. : dark blue skirts and tunics with silver buttons, berets, nylons and black shoes. Up forward, the coming of the engine was eagerly awaited ; and when *Queen Mabel* finally appeared, made her way through the maze of crossings, and backed on to the train, there was a loud cheer from a hundred feminine throats, while the television and film cameramen worked overtime. A shunter was waiting to couple up, thus saving Alice that bit of muscular exercise, and when he called O.K., Driver Joy made her brake test.



" Cameras clicked and whirred as ' Queen Mabel ' backed on to the train "

" Queen Mabel "

The locomotive, Sir Roy's " last word," was a 4-6-4 with four 20 in. × 28 in. cylinders, 135 deg. cranks, and two piston valves to each cylinder, one admission, one exhaust, separately adjusted for cut-off and release by two small concentric

wheels in the cab, the actual work being done by steam-operated servo-motors. The admission valves had Sir Roy's patented accelerator device. The outside valve-gear was Baker-Donalot ; the inside, Holcroft's final conjugation. The six coupled wheels were 6 ft. 3 in. diameter, on roller-bearing axles loaded to over 30 tons, this being permitted by the massive 150 lb. flat-bottom rails on all the S.R. main lines. All other bearings, including inside big-ends, were either ball or roller. The huge taper-barrelled Belpaire boiler carried 260 lb. pressure, had a mechanical stoker, and a rocking grate. Dual Westinghouse brakes were fitted ; electro-pneumatic for the train, straight air on the engine, operated in unison by a small controller like an ordinary brake-valve. A minor but important detail, now standard on all Southern engines, was an automatic blower-valve which opened every time the regulator was shut, completely eliminating the danger of a " blowback." It could be shut off separately, but the opening was always automatic, a point much appreciated by all the enginemen. The roomy cab had a sloping front like a car windshield, and armchair seats for the driver and fireman, all handles being within easy reach. The tender ran on two four-wheeled bogies, and had an automatic water-scoop, as the Southern had now installed water-troughs. Radio-telephone communication enabled the engine crew to speak to the guards, signalmen, stationmasters, etc., all along the line. The engine was finished in green, with black and gold lining, and chromium-plated steelwork ; the footplate fittings shone like gold. Apart from a shell-nosed smokebox, there was no streamlining, the sleek lines of the engine rendering it unnecessary.

The " siss-phut " of the Westinghouse duplex donkey-pump, gave the impression that *Queen Mabel* was a living, breathing creature, as she stood quietly at the head of the train, building up the air pressure in the reservoirs. Driver Joy and Fireman Alice wore the special green overalls that the latter had made, with jaunty mob caps to match ; also leather belts, gauntlet gloves, shoes and stockings in a matching shade of brown. While Joy, armed with a long-spouted oil-feeder, was taking a final look-around, according to engine-driving tradition, the girls swarmed all over the engine and plied Alice with questions. They were amazed when the lady fireman told them that she didn't put the coal on with a shovel, but just sat down and turned a little wheel ; and were more amazed still when Joy said it was much easier to drive *Queen Mabel* than the family Morris, because you didn't have to steer, nor look out for bikes dashing out of side turnings, and children didn't chase balls across the line. Also, as the tyres didn't puncture, there was no stopping on the road to change a wheel !

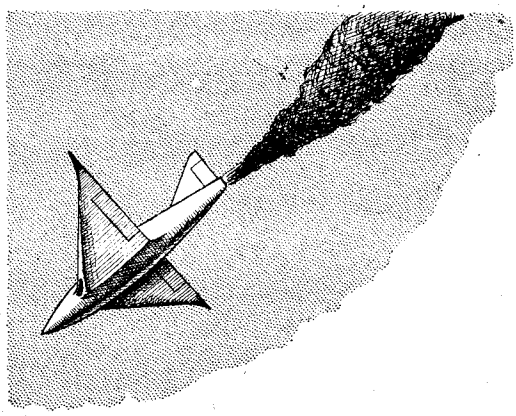
Right Away!

" The R.C.A. special leaves in two minutes—take your seats, please ! " came in a pleasant feminine contralto from the loudspeakers above the platform ; and there was an immediate rush for the cars. Plump, middle-aged Gert came bustling up with the running sheet. " Eighteen on, Joy—or twenty if you count me and Daisy—right time away." She stood back, with her green flag tucked under one arm, as the last of the girls entered the cars, and the Pullman hostesses came to the doors and gave the " all-ready " signal. " Stand away from the train, please," came the voice from the loudspeakers again, and as the crowd obeyed, Alice cracked the blower and started the stoker engine. *Queen Mabel's* safety-valves popped ; then " Phee-e-e-eep ! " trilled Daisy's whistle far back down the platform, Gert waved her flag, and stepped aboard. Joy blew a kiss to the crowd as she turned and gave a gentle pull at the big chromium-plated regulator handle, whilst Alice gave a tug at the whistle cord ; they were off !

" Whooo ! " said *Queen Mabel* in her harmonised contralto ; she gave a deep sigh as the steam rushed to the cylinders, and quivered as her six driving-wheels bit the railheads, and she took the strain. Whup-whup-whup-whup ! came the sharp staccato beats from her squat, but shapely chimney, as she slowly left the platform, to the accompaniment of loud cheering, and much clicking and whirring of cameras, and threaded her way through the crossovers, followed by her chocolate-cream retinue. Alice looked back along the train, said to Joy : " All right—we haven't left any behind," took a peep at the fire through the mica-covered sight hole in the firehole door, started the exhaust injector, and dropped into her comfortable seat.

As *Queen Mabel* cleared the last crossover and took the down main line, a green light flashed in front of Joy, just under the cab window. This was the cab signal repeater, a great improvement on the bell-and-horn device used on the Great Western. In the case containing the speedometer and electric clock, and set between their dials, were four small lenses, about as big as a shilling, arranged vertically. They repeated the aspects of the lineside colourlight signals in plenty of time to allow a driver to act on an adverse indication, and also flashed warnings of junctions and service speed restrictions. Joy notched up to 25 per cent. cut-off, adjusted the exhaust release to suit, and pulled the regulator halfway open ; *Queen Mabel* instantly responded, accelerating her 800-ton load like a powerful electric locomotive. " Now we're off," Joy called across to Alice, and she, too, sat down. The train slipped past the Vauxhall platforms, with the speedometer needle rapidly climbing ; past the locomotive depot at Nine Elms, under the Brighton line bridges, and then *Queen Mabel*, with a cheery " Whoo-oo-oo-oo ! " buzzed through Clapham Jct. well up in the eighties. Joy brought the cut-off back to 20 per cent. as the train flew through Raynes Park. Flash—flash—flash went the little green light every minute or so. Joy was leaning back and taking it easy as *Queen Mabel* shot under the Durnsford Road flyover, and " whooooed " joyously ere she roared through Wimbledon at the level 100.

The big " Hudson " was riding rock-steady, and the exhaust was just a purr. Joy looked across at Alice, smiled, and said, " Money for jam ! " " Goodness, you're telling me," replied the ashcat, as she glanced at the steam-gauge and



made a slight adjustment to the steam-valve of the stoker engine.

"Hey, Gert," called Joy into the telephone speaker. "Enjoying yourselves back there?" "Fine, thanks," came Gert's voice, "Me and Daisy are just going to the buffet-car for a cup of tea—coming?" "Don't be tantalising, or we'll break all your teacups," replied Joy, with a grin at Alice.

As they flashed through Surbiton, Joy brought the cut-off back to 15 per cent. and pulled the regulator wide open; then adjusted the exhaust release until the back-pressure gauge dropped to minimum. Up went the speedometer needle yet higher; flash—flash! went the cab signal, green every time. Esher, Walton Weybridge, and Byfleet were passed at ever-increasing speed, and then "Whoooo-oo!" remarked *Queen Mabel* once more, as she flew through Woking, taking not the slightest notice of the slight up-grade. As they cleared the station, Alice, leaning back in her seat, called to Joy: "*Lady Vera* was easy to fire, but this one is easier still. The blessed fire and water almost look after themselves." Joy nodded, "She's easier to drive, too," she replied. "She's handling our 18 cars better than *Lady Vera* pulled the 12 on the 'Golden Arrow'; but it's an easier road—there's that in her favour. Dad certainly hit it off with these cab windows, too; you get a grand view of the line ahead." As Joy finished speaking, she gave a start, and instinctively looked at the telephone speaker; this passed unnoticed by Alice, who at that moment got up from her seat and blew down the water gauge on her side of the cab.

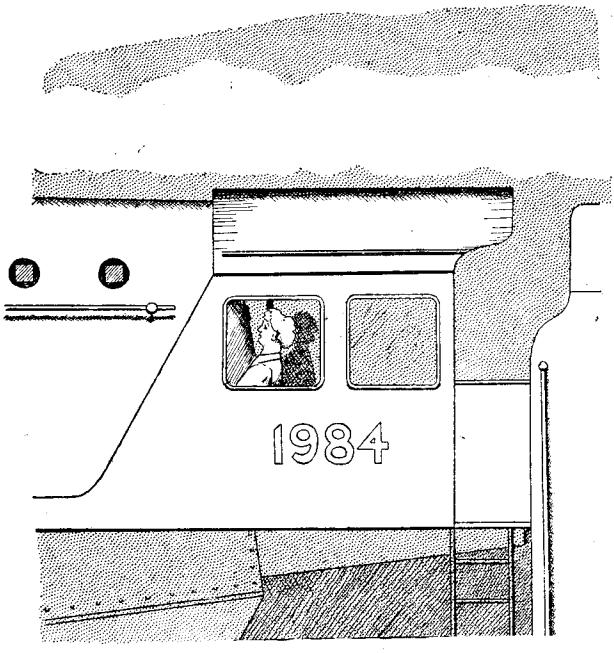
A Narrow Squeak!

Queen Mabel was doing her 2½ miles per min. as the train approached Farnborough. Joy had glanced up at the sky several times, as if expecting to see something; and as the train roared through the station, a small single-seater aeroplane flew overhead, going the same way, and keeping above the railway line. Joy suddenly went pale, stood up, and grasped the regulator handle, peering intently through the cab window at the aircraft, now some distance ahead. "What's up, Joy?" called Alice. "I don't like the idea of that plane right above the line," said Joy. "If anything happened to it——" Hardly were the words out of her mouth when the little aeroplane swerved violently from side to side; a plume of black smoke poured from its tail, and it began to drop. "Good heavens!" screamed Joy, "it's going to crash right in front of us—shut down, Alice, quick!" And like a flash she slammed the regulator shut, and flung the handle of the brake controller into "emergency," Alice, equally quick, shut off the stoker engine, dropped the dampers, and put on the live steam injector. As the fabric-lined brake blocks gripped the wheels with a three-ton pressure on each, the effect was as if a giant hand had gripped the last car and was trying to hold the train back.

"Joy, dear, whatever's gone amiss?" came Gert's anxious voice through the speaker.

"There's a little aeroplane going to crash on the line in front of us, but I think we'll stop in time—tell the girls to keep their heads," yelled Joy. A few tense seconds followed; then, as the 'plane finally hit the ground, with one broken wing lying right across the down main line, *Queen Mabel* came to a stop not thirty yards away!

Joy scrambled down the cab steps and ran towards the wreckage; Alice shut off the injector and followed. Gert, Mrs. Hood, and a crowd of



"Good heavens!" screamed Joy "It's going to crash on the line"

the girl passengers came hurrying up ; and the local permanent-way gang, who had been working close by and had seen the crash, came running up from the opposite direction. All were expecting to see the aircraft burst into flames, but to their great relief, it didn't. Then a young man climbed slowly out of the smashed cockpit ; he was limping badly, ruefully rubbing one arm, and blood was oozing from a cut on his forehead, but he appeared to have no bones broken. He limped towards the group, and said : " Thank Heaven the train stopped ; if the engine had hit my kite, it would have knocked it into match sticks, and I'd have had it ! My first duty is to go and thank the driver."

" I'm the driver," said Joy.

" You ! " He stared straight at her for a few seconds ; then, acting on a sudden impulse, he sank on his uninjured knee, took Joy's hand, bent his head over it, and reverently kissed it with all the courtesy of a knight of olden times.

Driver Joy had nerves of steel, but a very feminine heart beat beneath her green overalls ; and that simple act of devout thankfulness so affected it, that she nearly collapsed in a flood of tears. Big motherly Gert turned aside and coughed suspiciously ; Mrs. Hood's handkerchief suddenly appeared, and there were some starry eyes among the girl passengers—feminine emotion is beyond the ken of man ! However, Joy controlled herself with an effort, forced a smile, and assisted the airman to his feet, saying : " Well, Mr. Sparrow, I've only got one neck and I'm mighty fond of it ! Besides, my passengers want to go to the seaside, not to hospital. But, my goodness ! Weren't you lucky the whole lot didn't catch fire, you'd have been burnt to a cinder."

" It couldn't catch fire," replied the pilot, " You see, the engine is a small jet which I designed to burn crude oil ; stuff like treacle, that wouldn't light even if you put a match to it. I was going to Bournemouth to give a display at the gala, and like a b—— I beg your pardon, ladies—like a fool, thought I'd follow the railway instead of navigating. But I shan't get to Bournemouth now," he added ruefully.

At that moment the permanent way ganger came up. " We've shoved the broken wing clear of the line, ma'am," he said, " and there's no damage to the rails, so it's all right for you to proceed. I'll telephone for the breakdown gang to come and clear up the mess."

The guard is responsible for the running of a train, so Gert took command at once. " All right," she said, " All aboard girls, as quick as you can. Daisy, you hurry back to your car, radio the stationmasters at Woking and Basingstoke, tell 'em what's happened, say we're all right, the navvies have cleared the line, and we're going on." She looked at her wrist-watch. " We're only about three minutes down ; you had a couple in hand, Joy, so if you step on it, we shan't be late for lunch. As for you, young man," she added, turning to the airman, " you'll get to Bournemouth after all—it's safer by rail ! Up you go into my front parlour, and I'll fix your damages ; all our trains carry first-aid kit, and I'm a qualified nurse." She helped him up the Pullman steps, and followed.

Alice was already up in the cab, and had started the stoker engine. As Joy was about to follow, a stewardess from the buffet car, hurried up with two cups of tea and some cakes on a small tray. " We thought you could do with these," she said. " Ducky, you're the enginewomen's best friend," said Joy, taking the tray and and passing it up to Alice. The stewardess hurried back ; Joy climbed up into the cab, and looked back along the train. Everybody was in ; Daisy gave the " all right " from the rear, Gert leaned out and waved her flag, Joy dropped into full gear, opened the regulator, and gave a tug at the whistle cord. The permanent-way lengthmen waved their caps as *Queen Mabel*, with a musical " whoo ! " moved off once more.

A Race Against Time

Joy took a drink of tea, and called across to Alice : " We shan't half have to hop it, to get there on the dot ! " Alice, her mouth full of cake, just nodded, as she started the exhaust injector, and opened up the stoker engine valve a bit more. The two women then gave a display of enginemanship that would have done credit to the Southern's crack top-link crew. It takes a skilled driver to work a four-cylinder high-pressure locomotive right to her maximum acceleration point without slipping, yet Joy did it. With one hand on the long regulator handle, and the other on the outer reversing wheel which controlled the cut-off, she operated first one, then the other, and *Queen Mabel* accelerated her 800-ton load at a rate which, the girls said later on, made the Pullman seats push their backs ! The smash had occurred near Fleet Station, yet by the time the train passed Winchfield, on a rising grade, *Queen Mabel* was doing just on 90 m.p.h. and with full regulator and 20 per cent. cut-off, she roared through Basingstoke with the speedometer just over the 110. This was easily sustained up the 1 in 249 to Worting Jct. The cab signal gave two yellow flashes, followed by one green, indicating that the line was set for the Bournemouth road, *Queen Mabel* bore slightly to the left, and on the somewhat easier grade she accelerated to 120, ere she topped the summit and dived into Litchfield Tunnel with a defiant " whoooooo ! "

Then the fur began to fly with a vengeance. Joy left the regulator wide open, but brought the cut-off back to 15 per cent. and opened up the exhaust release ; and *Queen Mabel* just gathered her skirt and " went for it." She flew through Popham Tunnel like a bullet through a gun barrel, and dashed through Micheldever Station at 2½ miles per min. As she approached the tunnel at Waller's Ash, Joy and Alice pressed their hands over their ears ; the " bonk ! " as the rush of air hit the cab was enough to damage their ear drums. Alice held down the whistle cord to give Winchester good warning ; the speedometer was on the 160 as they tore through the station. Joy called : " Gert ! " into the telephone speaker. " Yes, dear ? " came the answer. " Are the girls scared ? " asked Joy.

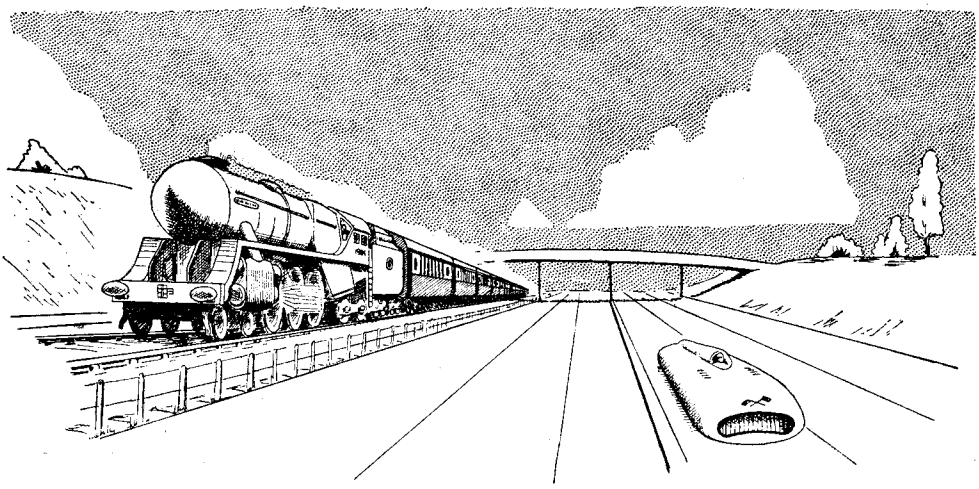
" Bless your heart, no—they're enjoying it no end," replied Gert. " Some of 'em are trying to time the train speed, and reckon you'll soon be doing three miles a minute."

Joy laughed, " O.K." she said. " Tell 'em to sit back, hold tight, hang on to their hats, and I'll have a smack at it when we get on the loop line."

Eastleigh Works staff had turned out to see the special train go by, but they didn't see much of it ! *Queen Mabel* gave a prolonged " whoo-o-o-oo ! " ere she roared through the station and passed the works. The staff raised a cheer as they just caught a fleeting glimpse of Joy, now hatless, leaning forward a little, her hand on the regulator handle, watching the line ahead ; but the enginewomen never heard it. A flash of green and silver, a slightly longer one of chocolate-cream, a clatter like a machine-gun as the flying wheels rushed through the crossing frogs, a cloud of ballast dust, and the train was gone. The erecting-shop foreman said to the foundry foreman as they went back to the shops : " In all the years I've worked here, I've never seen a train go through as fast as that. It'd be something for one of our top link drivers to shout about ; but the guvnor's daughter—well, it just bangs Banager ! "

Flash—flash ! went the yellow light again, followed by three green flashes. " All set for the loop, Alice," called Joy. The road was laid so that trains taking the Southampton avoiding line, need not slacken speed. *Queen Mabel* dashed through the junction, and entered what was the latest and finest stretch of line in the whole country. About a quarter-mile farther on, were the water-troughs ; and here *Queen Mabel* " had a quick one," without any help from Alice. The scoop was lowered and raised by an air cylinder, the lowering being controlled by a magnetic valve, energised by passing over an inductor set between the rails a little way ahead of the troughs. When the tank was full, a float-operated arrangement reversed the valve, and the air cylinder lifted the scoop. As the latter had Sir Roy's patent splash guards, very little water was wasted, and the tender never overflowed. The whole operation was entirely automatic.

The Southampton avoiding loop-line was just over 23 miles long, and rejoined the old line at New Milton. It was very nearly straight, practically level, and had no stations, so formed an ideal " galloping ground." When it was first projected, the Hampshire County Council, with commendable enterprise and forethought, suggested building a section of the south-western arterial motor road alongside it at the same time ; this was done, and road and railway ran side by side for most of the distance. The road was double-tracked, for three lines of traffic each way, and there were no road junctions, as all cross roads bridged both it and the railway ; consequently, motorists could enjoy themselves to the full. It joined the railway a mile past the water troughs ; and as soon as Joy sighted it, she said : " Now we'll show 'em how to march on—keep her on the pin ! " and advanced the cut-off to 20 per cent. adjusting the exhaust release to suit. Fast as she was already going. *Queen Mabel* instantly responded, and the speedometer needle moved up. Faster and faster flew the train. Alice was watching the steam and water gauges like a cat watching two mouse-holes at once, making adjustments to stoker and injector feeds as needed. Motorists on the adjoining road, hearing the train coming, put on speed and tried to keep up with it—some hopes ! Suddenly Joy spotted a long black car some way ahead, going at a tremendous speed, and called out " Alice, I believe that's the N.B.G. racing car the papers made such a fuss about—wonder if it can keep up with us ? " Alice crossed over, looked through the cab window, and said " You're right, Joy ; let's tell the driver we're coming," and she reached for the whistle cord and blew three long " whoos " ere she sat down again. The car put on speed, but *Queen Mabel* overhauled and finally passed it, to the great delight of the girls in the Pullmans. Both enginewomen heard their cheering coming through the speaker ; they then heard a shrill voice scream, " Hooray, she's done it—three miles in a minute ! " followed by more " hooraying," and



" ' Queen Mabel ' overhauled and finally passed it "

the strains of the children's old school-treat refrain "Good luck to our engine-driver." Joy glanced at the speedometer; the needle was just trembling on the 180 mark!

Bournemouth was now only about 14 miles away, and they were nearing the end of the loop line; so Joy shut the regulator, whilst Alice shut off the stoker engine, dropped the dampers, and filled up the boiler with the live steam injector. The speedometer needle dropped slowly back. The motor road rose up and crossed the railway by a concrete skew bridge, under which *Queen Mabel* rushed with a loud "Yah!" The cab signal flashed its warning for the west junction of the loop; the train thundered through it, passed New Milton Station, then coasted down the bank, through Hinton Admiral, to Christchurch, whence the up grade to Boscombe further reduced the speed. Joy made a brake application as they passed the station, and then another, as Bournemouth Central hove in sight; finally, *Queen Mabel* came to rest, without jar or jerk, alongside the down main-line platform, having made the run from Waterloo in a few seconds under 80 minutes, despite the delay caused by the aeroplane crash.

All's Well that Ends Well!

The train rapidly emptied; Mrs. Hood came up to the engine and called to Joy and Alice, "Grand Hotel, half-past twelve—don't be late!" A shunter uncoupled the engine; Joy ran her to the sheds, and left her in the care of the shed staff until it was time for the return trip. Joy and Alice then made for the office-girls' room, where they washed, changed into summer frocks, and performed the feminine ritual on their hair and faces, after which they joined Gert and Daisy, who had also changed and titivated up in the ladies' room at the station. After a stroll along the front, they made their way to the Grand Hotel; and it was hard to believe that the quartet of fashionable ladies who entered that establishment, were the driver, fireman, and guards of a special express train from London, which had that morning not only broken all speed records, but had narrowly avoided a disaster on the way.

The luncheon was a huge success. After the girls had honoured the Royal toast, and of the Southern Railway, and the R.C.A., Mrs. Hood got up and proposed the toast of the train crew, coupled with the name of Driver Joy, whose prompt action in time of emergency had avoided what might easily have been a serious accident. "Indeed," added Mrs. Hood, "she acted so quickly, that one might well imagine she had received some warning that danger was ahead!" The toast was received with great acclamation; and the rendering of "For She's a Jolly Good Fellow" by five hundred young feminine voices, had the Luton Girls' Choir, or any other choir for that matter, beaten to a frazzle! When the noise died down, Joy stood up and made a short speech of thanks, concluding "It was strange that Mrs. Hood made that remark about a warning, for I actually *did* receive a warning! I'd just remarked to Alice that the cab windows gave a grand view of the line ahead, when a quiet voice, right close to my ear, said 'And the sky, Joy—watch that too!' *That warning came from another world, for the voice was that of a very dear friend whom we knew as Curly.*"

"The Good that Men Do . . ."

Our old friend, Wilfred L. Randell, author of our two handbooks, *Clock Repairing and Adjusting*, and *Watch Repairing and Adjusting*, has received, among a number of letters, one from a horological friend that is worth quoting; for the writer comments: "... how much, how very much, I have enjoyed reading your two little books. They are a gateway (as is B's 5th Symphony) through which many will enter to great pleasure and interest. When I was running .....Correspondence Courses, I always found your books especially suitable for the sick (T.B. cases, spinal cases, etc.) who needed something more 'matey' to back up our rather terse instructions; not all of which were particularly suitable to quickening interest, so vital to recovery in men climbing back to life. You may like to think that you have helped in this way."

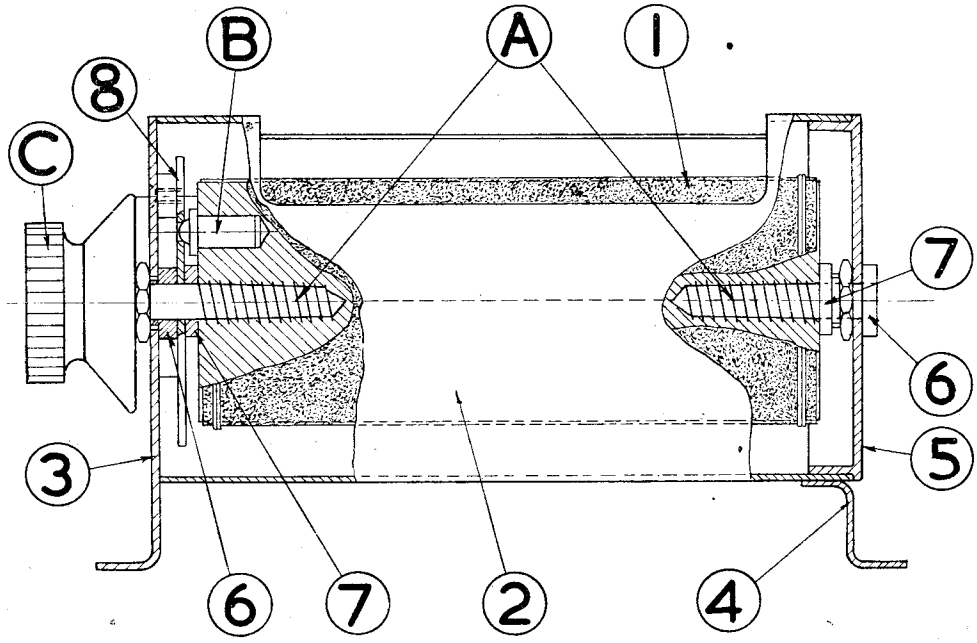
Replies to queries, technical and otherwise, are rather apt to be terse and soulless; not because the tutor deliberately intends them to be, but because exigencies of time compel him to be as brief as possible in passing on information. The author of a book, even of a technical book, has the opportunity of being more human, more himself; and writers like Wilfred Randell do not hesitate to seize that opportunity. At the same time, they clearly realise that, among their readers, there are bound to be a few in need of some subtle something other than mere technical instruction. Enthusiasm must be kindled; interest must be stirred, and the author, who can infuse into his writings the effects of the good-natured smile and the friendly helping hand while imparting vital information, is the one most likely to win the respect and gratitude of his readers, and to provoke the reactions which only friendship can provoke.

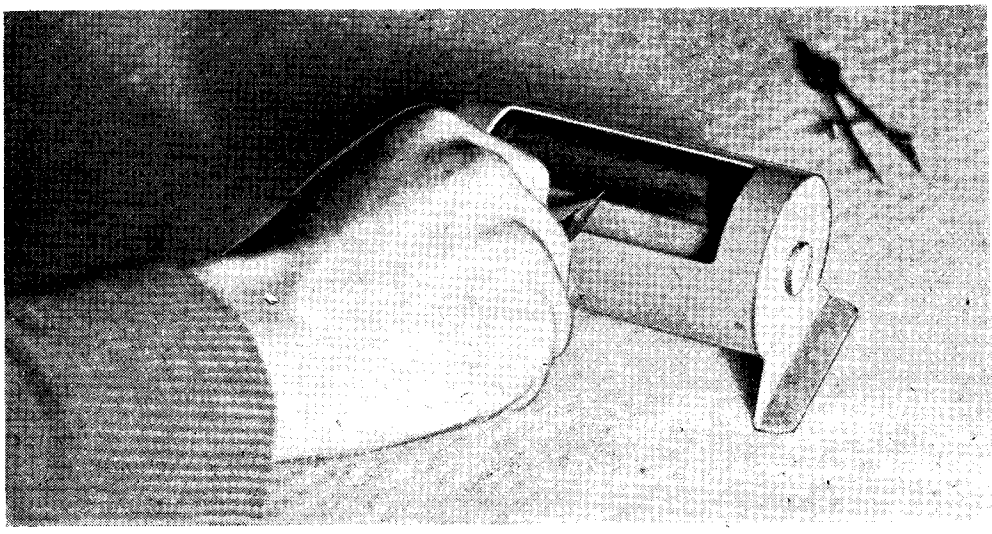
THE "HEXO-KEEN"

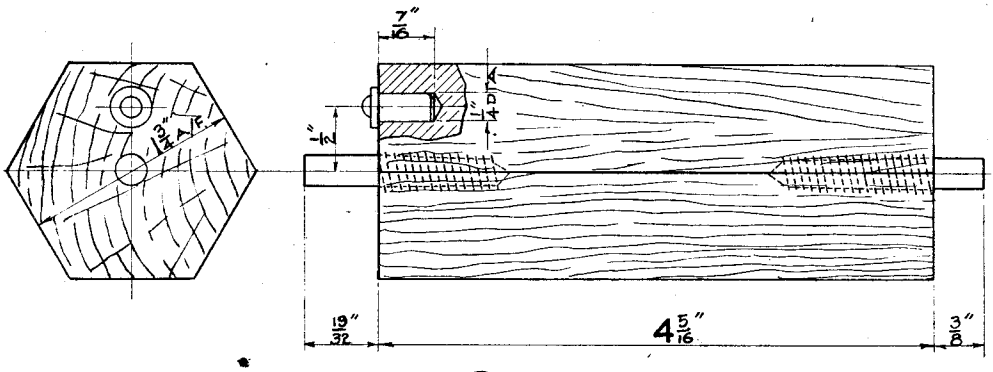
A Useful Pencil Sharpener for the Draughtsman

By R. H. Rudd

THE usual method employed by draughtsmen for producing keen edges on their pencils is an old file or rubbing block, which, due to constant usage, gives way to dirty localised surroundings. Too well he knows how the graphite tiresomely gets on to his drawings and clothes. Then there is that dirty file, scrounged from the workshop, which somehow, wherever placed, seems attracted by one's best pair of trousers!







(1) WOOD 1 OFF

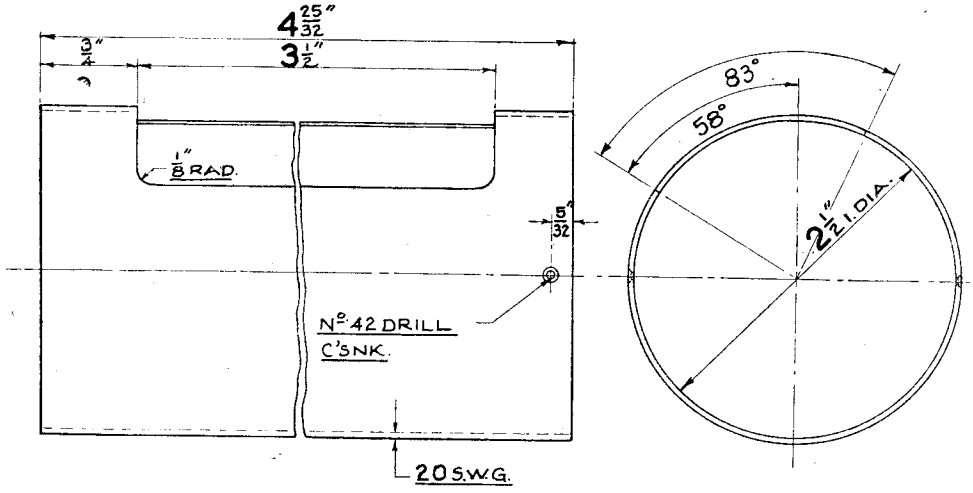
The simply built "Hexo-keen" illustrated overcomes these annoying occurrences. It consists of a hexagonal wooden block (1) which has, screwed into its ends, No. 14 wood screws, cut off to the appropriate length, which form the bearing spindles. These bear in the panel bushes, or alternatively, panel bushes (item 6), as used in electronic work, are admirable for this purpose. A spring-loaded ball catch (similar to those used on cabinets, etc.) (*B*) is fitted tightly in an appropriately drilled hole in the hexagonal block (1). The ball engages in a catchplate (8) which has six locating holes drilled in it, thus enabling (1) when assembled to be turned into six possible positions. The catchplate (8) is secured to the end-plate (3) by the medium of three No. 6-B.A. countersunk screws that screw into hank bushes or nuts that are soldered to (8). The cylinder (2) which has an aperture in the upper side, is soldered to (3) and to its other end similarly soldered, but the lugs, is the support (4).

A turned end-cap (5), which fits snugly into the end of the cylinder, is secured by two No. 8-B.A. countersunk head screws, and thus readily made removable for emptying of Hexo-keen when necessary. A bakelite knob (*C*), held to the bearing spindle by grub-screws, enables the block (1) to be turned to any of the six desired positions. A skirted knob, as shown gives a better appearance than does the ordinary non-skirted type of radio control knob. Item (7) are washers.

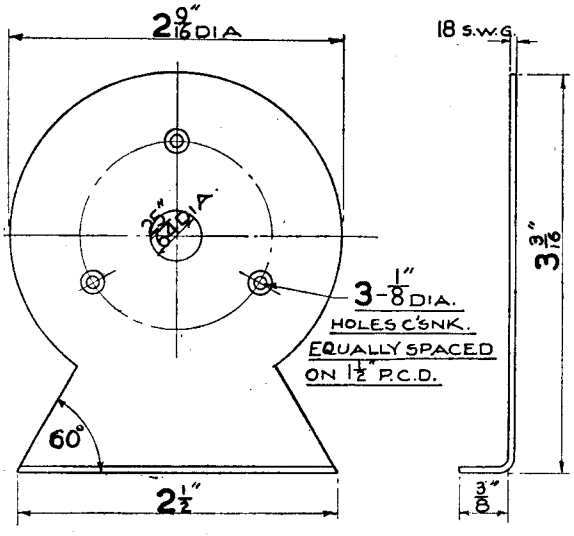
Attached to (1) by a rubber band at either end is the glasspaper on which the actual sharpening of the pencil lead is done.

It will be seen that since the "Hexo-keen" has six working surfaces, a change of glasspaper is very infrequently necessary. When in use, free graphite left on the surface of block is shot into the bottom of the cylinder by turning the knob.

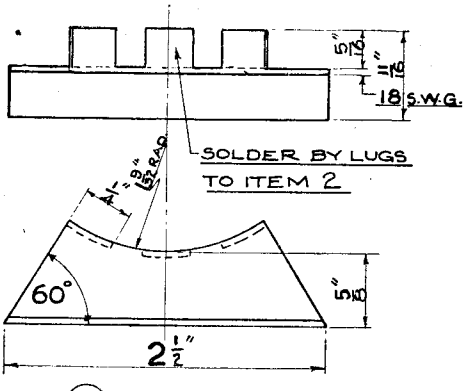
The outside of the device, except for the knob, may be painted in any desired colour.



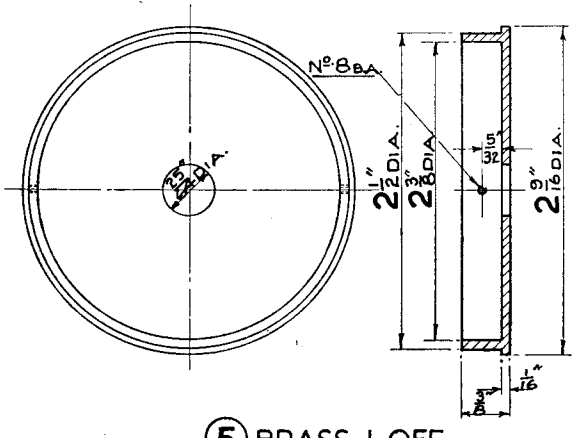
(2) BRASS 1 OFF



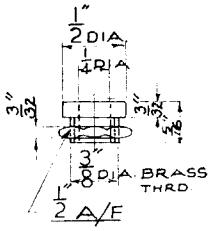
3 BRASS 1 OFF



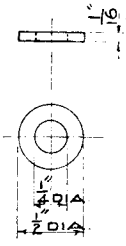
4 BRASS 1 OFF



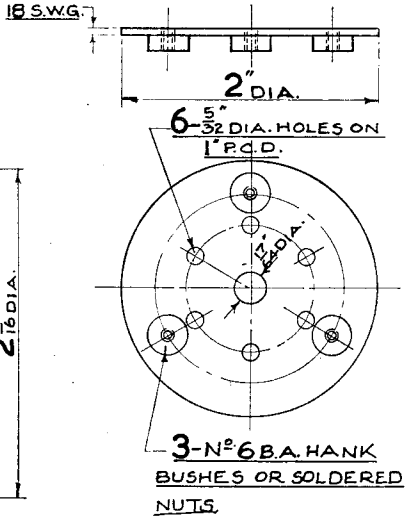
5 BRASS 1 OFF



6 BRASS 2 OFF



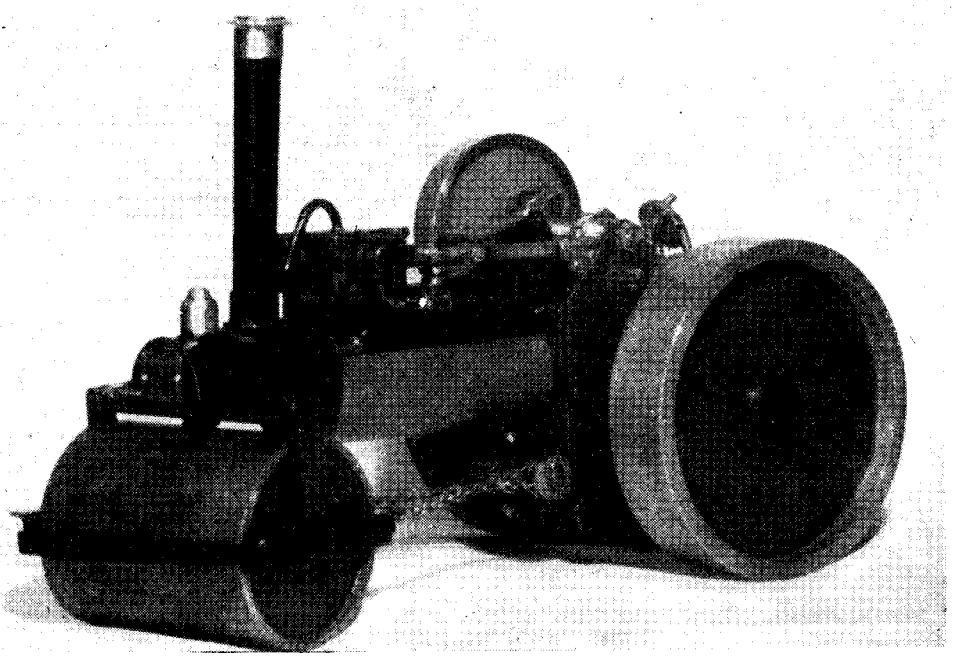
7 STEEL 2 OFF



8 BRASS 1 OFF

A STEAM ROLLER FROM SCRAP

by G. C. Bird



THIS little steam roller was inspired by "The Story of a Quickie" which appeared in THE MODEL ENGINEER a couple of years ago. I have a small nephew and thought a steam roller might add to the interest in a small boy's life.

The first operation was (as in most cases like this) a good delve into the old scrap box. A piece of 3/32-in. plate was found, together with a piece of copper tube, 1½ in. dia. I could visualise a steam roller with the 3/32-in. plate as the horn plates and the copper tubing as the boiler. The whole model was designed around these pieces.

An outline sketch was made of how the roller was intended to look, but, like most things I set out to make (except my "Twin Sister"), it was not much like the drawing. The main difference between the original drawing and engine is that an oscillating cylinder was originally planned. Knowing small boys, I imagined the chief objection to this would be "Mummy, it won't go backwards!" So a double-acting reversing engine was decided upon. Fig. 1 shows a drawing of the roller as it appears in the photograph.

Now for the details of this little job:— Hind wheels, 4⅜ in. dia.; roller, 2½ in. dia.; wheelbase, 7⅛ in.; height to top of funnel, 7⅛ in.; flywheel, 2½ in. dia.; cylinder, ½ in. bore × ¾ in. stroke; working pressure, 20 lb. per sq. in.

The cylinder was cut out from a solid piece of steel; not the ideal metal for cylinders, I know, but it does serve the purpose. The port-face, which is separate from the block, is 1/16 in. stainless-steel. This was, in a way, a bit of an experiment, which has turned out to be satisfactory. Steam distribution is effected by a slide-valve actuated by a slip eccentric. The slide-valve is in gunmetal.

Having settled the engine details, I thought perhaps a beginning should be made on the boiler. Numerous designs were schemed out and I considered the most satisfactory type would be similar to a Smithies "pot" boiler, but without the water tubes. This was made and fixed to the hornplates.

The wheels, which came next on the agenda, presented a problem, machining these from the solid would involve too much arduous work.

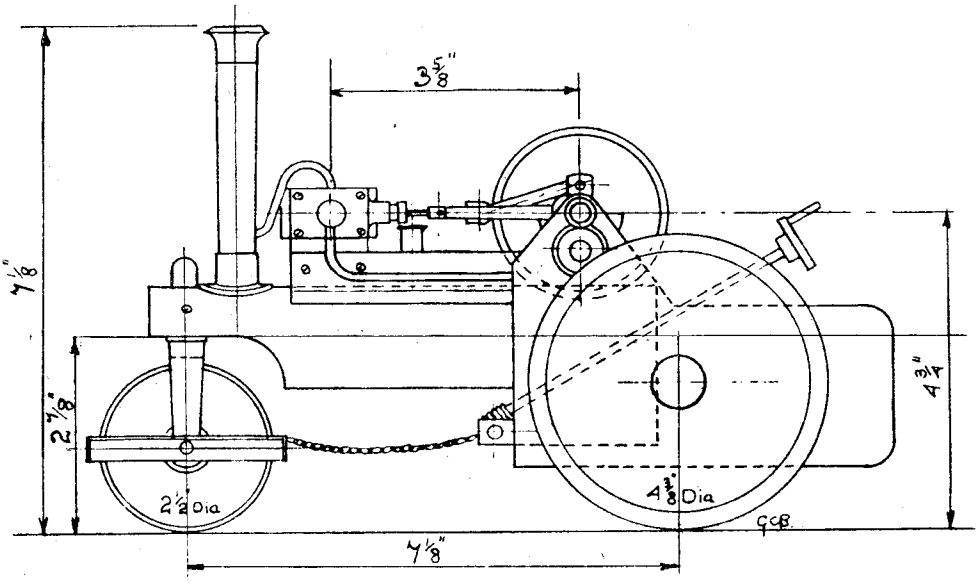
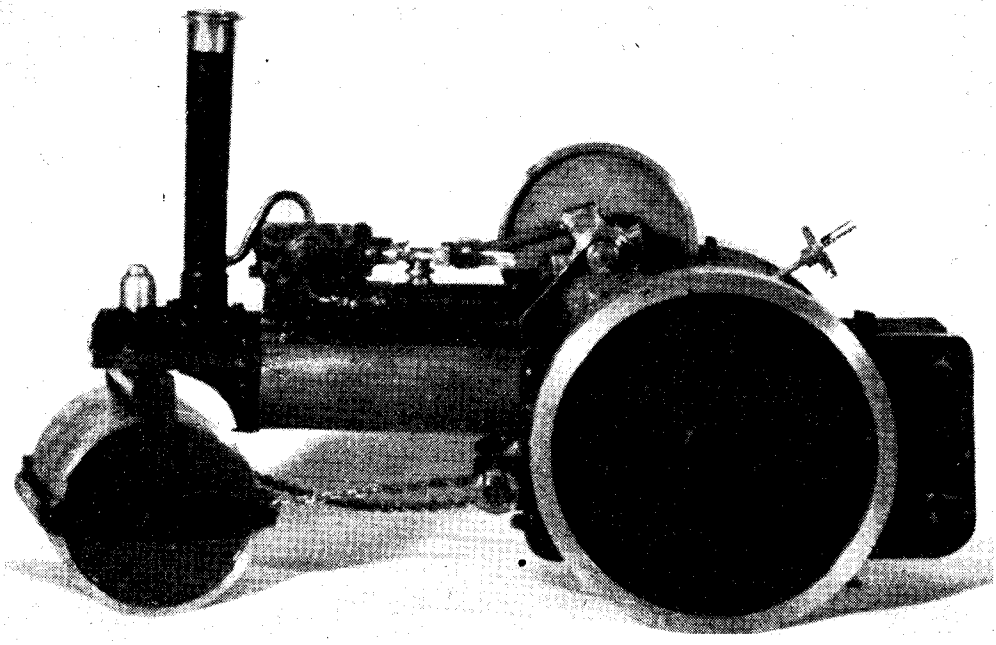
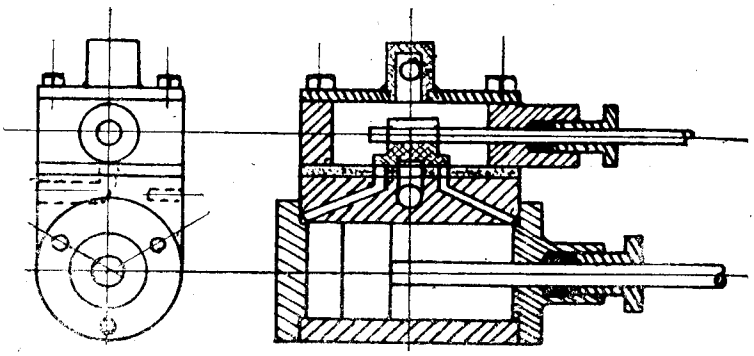


Fig. 1. Side elevation of the model steam roller

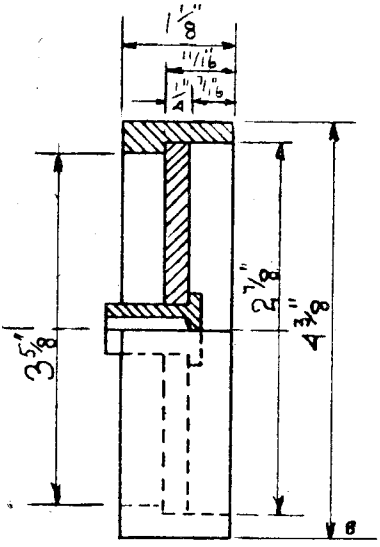


Side view of the completed model steam roller

Right—Fig. 2. End view and section of cylinder, ½ in. bore × ¾ in. stroke



Below—Fig. 3. Half section of hind wheel, showing method of construction



Castings were out of the question, so it was decided to fabricate them. I managed to scrounge two pieces of suitable tubing, 4½ in. dia. × ⅜ in. thick. Both these pieces were machined with a step inside to allow a disc, complete with wheel boss, to be pressed in. The wheel bosses are a good fit on the axle and keyed to this by 3/32 in. dia. keys. The flywheel was constructed in the same manner.

The gearing is a set of spur wheels gleaned from an old alarm clock. The ratio from crankshaft to axle is 30 : 1, and I have since found that this ratio is too low. When the little engine is doing an enormous speed the whole roller perambulates very slowly across the floor. There is one advantage with this, and that is that the little fellow will climb over lumps in the ground out of all proportion to its size.

On the whole, I found it quite enjoyable constructing this little machine. In fact, I was rather sorry that I had not made it for myself.

And now back to my "Twin Sister."

For the Bookshelf

Model Steam Locomotives, by Henry Greenly. (London : Cassell & Co. Ltd.) 320 pages, size 5½ in. by 8 in. Profusely illustrated. Price 15s. net.

This is the seventh edition of a well-known treatise on the design and construction of steam locomotives in all sizes from 1¼-in. to 15-in. gauge. It has been considerably revised by Mr. Ernest A. Steel, M.I.J.E., who has deleted certain items, added others and modified existing detail, where required, so as to bring the book more into line with the modern outlook on the subject.

The illustrations, which are very numerous, include only about half of the originals, most of the rest being new ; the various tables of useful dimensions and other particulars have been modified and, in some cases, corrected. In spite of all this, the distinctive character of the original book has been well maintained and the Greenly tradition sustained. The book is essentially descriptive rather than constructive.

We are surprised to note that, in the graphs of the bench tests, reproduced on pages 312 and 313, as well as in the paragraph referring to them on page 315, no indication of the sizes of the two engines is given ; both are for 5-in. gauge and this ought to be stated, otherwise the graphs do not mean anything.

British Cars, 1951, by Peter Chambers. W. & D. Willett Ltd., 74, Leadenhall Street, London, E.C.3. Price 6s.

Once again, Peter Chambers has made a masterly job of his annual collection of photographs and data relating to British cars, and the resulting handbook is one which should be in the hands of all car lovers. The alphabetical arrangement makes reference to any particular make an easy matter, while the specifications at the back of the book will be of great value to intending modellers, as well as to those whose interests spring from a more utilitarian point of view.

A DOMESTIC GAS POKER

by A. Smith

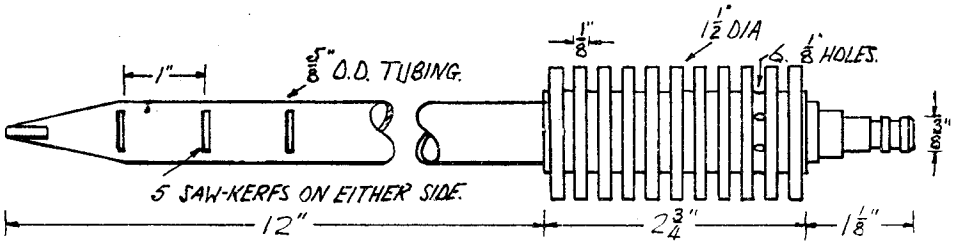
HAVING a wife who, bless her, has great difficulty in lighting a fire, it was decided that the workshop must be called in to rectify this difficulty. As a gas point was situated in close proximity to the fire, a gas poker, making use of this supply, seemed the simplest device to adopt.

The photograph and drawing will make clear the method of construction, all material being taken from the workshop scrapbox. A start was made on the barrel, which consisted of a 15 in. length of $\frac{5}{8}$ in. outside diameter conduit tube. This, after sawing to length, had its ends filed square. It was then mounted between centres in the lathe, cleaned and polished by applying emery-cloth as it revolved.

jig for twisting would be necessary, and as it was only a "one-off" job, this seemed a waste of time. It was decided to follow i.c. engine practice and have a finned handle for the dissipation of the heat. This has been found perfectly efficient in use.

As the scrap box did not contain a sufficiently large piece of light alloy from which to machine the handle, some odd pieces of aluminium were melted and cast in a mould made in tinplate. a little scrap zinc was added to the melt to improve the machinability of the resulting metal.

All the machining was performed with the stick of metal gripped in the lathe chuck, the bore being made a push fit on the conduit barrel.



Dimensioned details of the domestic gas poker

The end was flattened and closed by hammering and five saw-kerfs made on either side at 1 in. apart. At the other end a nozzle was necessary to take the $\frac{3}{8}$ in. diameter gas rubber tubing. The nozzle was turned from an odd scrap of brass, the bore being 5/32 in.; this will, however, depend on the individual gas supply and pressure.

An attempt was made to form the commercial type of wire handle, but it was found that a

The finning was done with a $\frac{1}{8}$-in. parting tool, the temptation to taper them *a la* aforementioned i.c. engine being severely resisted. Six air-holes were drilled as shown, after the handle had been fitted.

The poker operates excellently, the consumption of gas being very small, as it is only necessary to have it burning for two or three minutes. On the other hand, the prestige of the workshop has risen tremendously!

The complete gas poker connected to a length of rubber tubing

Novices' Corner

Machining Brass and Bronze

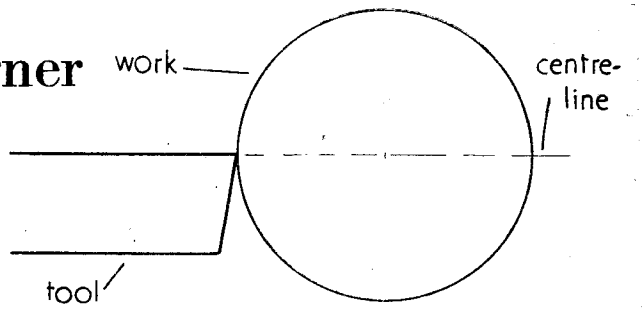


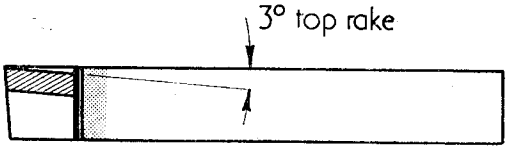
Fig. 1. Position of the tool for turning brass and bronze

ALTHOUGH these two alloys have very much the same appearance, they differ greatly both in composition and in machinability.

In normal times bronze, by reason of its higher copper and tin content, costs more than brass where the more expensive ingredients are replaced by a higher proportion of zinc. The ordinary gunmetal castings, supplied for making steam engine cylinders and other parts, represent but one of the many varieties of bronze.

This alloy is used partly because it wears well and can be machined easily, and at the same time it does not readily corrode.

Phosphor-bronze is another type that is employed largely for making bearing bushes, as it is highly resistant to wear but is rather tough to machine. Lead-bronze, however, is readily machined to a high finish, and this alloy can be used for the bearings of an unhardened steel shaft, as there is then but little danger of the bearing surfaces becoming scored.



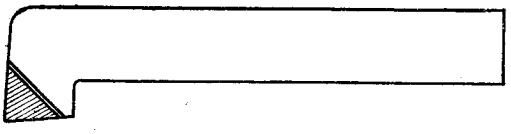


Fig. 2. A tungsten carbide-tipped tool for turning and facing

To obtain the best results, both brass and bronze have to be machined by the proper methods; these are much alike for the two alloys, except that some modification is needed for dealing with the harder kinds of bronze.

Turning Tools

When turning steel in a treadle lathe, experience soon shows that increasing the cutting rake of the tool gives freer cutting and at the same time saves leg power. This would also apply to brass and bronze, but as soon as the cutting edge is given much rake, the tool tends to be drawn into the work and a dig-in results.

Negative Rake

As shown in Fig. 1 the tool is, therefore, generally ground flat on its upper surface and the cutting edge is set level with the centre-line of the work. However, to promote free-cutting, it is often possible to use a tool with some 5 deg. of rake, but this is a matter that must be determined by experiment to suit the particular kind of alloy being machined. When machining some of the harder bronzes, it may even be found that the machining becomes easier and a better surface finish is obtained if the tool is given negative rake; that is to say, the upper surface of the tool slopes downwards towards the cutting edge.

The difficulties arising when machining bronze castings are similar to those previously referred to in describing the machining of iron castings, for the adherent sand and scale will quickly blunt tools made of carbon-steel or even high-speed steel.

The remedies are also similar; that is to say, either the castings should undergo a preliminary treatment in an acid pickling bath, or a tungsten carbide-tipped tool may be used to save this additional work.

A General Purpose Tool

The tool illustrated in Fig. 2 is a general purpose, tungsten carbide-tipped tool that will serve for taking both traversing and surfacing cuts, and when the work is run at high speed an excellent surface finish can be obtained. The particular grade of tungsten carbide tool suitable for turning bronze is either Messrs. Wickmans Grade "N" having a red shank, or Prolite 15A, or Messrs. Buck and Hickmans SX Grade "A." Moreover, tools of these grades can also be employed for machining cast iron and they are, therefore, almost indespensable in workshops where castings are largely dealt with.

The manufacturers recommend a top rake of 3 deg., and a clearance of 8 deg. is given to the two side faces forming the cutting portion of the tool.

Tools for boring gunmetal are best ground without either front or top rake to prevent

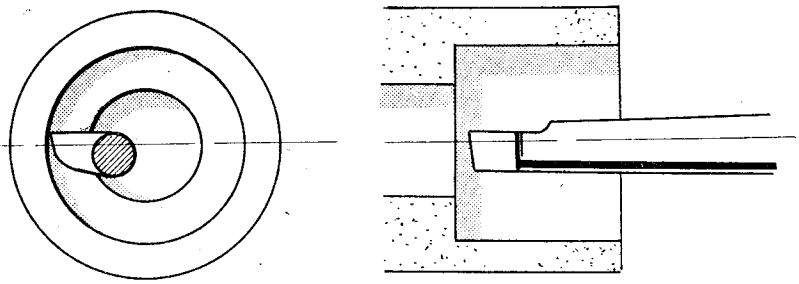


Fig. 3. Showing the setting of the tool for boring bronze

digging-in ; but it is safe to use a few degrees of rake when machining some of the bronze alloys—again, a matter to be determined by experiment.

As shown in Fig. 3, the boring tool will often cut better when set a little above centre height, for then the cutting edge will tend to move clear of the work if the tool springs under the pressure of a heavy cut. It is, however, essential to mount the tool with a minimum of overhang in order to prevent as far as possible any tendency for the tool to spring.

Where the tool is not rigidly mounted, the vibration set up when cutting gives rise to an intermittent, low-pitched sound that can be readily heard ; whereas, with a rigid tool a crisp, even note is emitted. Needless to say, the irregular cutting produced by a whippy tool will form a poorly finished and inaccurate bore.

Speeds for Turning and Boring

The machining speed will vary greatly according to the composition of the alloy. Ordinary yellow brass can be turned with high-speed steel tools at a surface speed of from 200 to 300 ft. a minute ; that is to say, a 2 in. diameter bar, having a circumference of approximately ½ ft., can be run at about 450 r.p.m. Bronzes, on the other hand, are usually much tougher and so require a slower machining speed of from 50 to 100 ft. a minute. But, again, the turning speed will vary with the particular type of alloy, and it is generally best, therefore, to play safe and use a moderate speed, except perhaps when a large batch of parts has to be machined, and time will be saved by finding experimentally the fastest speed that can be used to give satisfactory machining without excessive tool wear. With tungsten carbide tools, however, these turning speeds can be greatly increased, and the limiting factor is usually the driven speed of the lathe, as brass, bronze, and gunmetal can in this way be machined at from 500 to 1,000 ft. a minute. Should chatter occur when turning these alloys, the lathe should be run at a slower speed, and it may be found necessary to reduce the length of the tool's cutting edge in contact with the work ; in addition, care should be taken to see that the lathe mandrel and slides are correctly adjusted and that the tool is rigidly mounted with the least possible overhang.

Fig. 4. A straight-flute drill

Drilling

There is usually no difficulty in drilling brass, except that the drill has a marked tendency to dig in and rotate the work as the point breaks through ; this may cause injury to the hands and it is advisable, therefore, to hold small work-pieces in a machine vice. It may be found almost impossible to drill some types of bronze with an ordinary twist drill, for as soon as the drilling pressure is applied the drill catches in the work and becomes locked. In commercial practice, special drills are generally employed for this purpose ; these either have straight flutes as shown in Fig. 4, or the angle of twist is much reduced in order to lessen the rake at the drill's cutting edges.

In the small workshop, however, where the equipment may be limited, this difficulty can be overcome by grinding or honing the lips of an ordinary twist drill so as to reduce the cutting rake. The method usually adopted is illustrated in Fig. 5.

Small drills are best treated with a carborundum slip, but the larger sizes of drills can be more easily shaped on the grinding wheel. For the sake of clarity, the extent of the ground area illustrated has been purposely exaggerated, and in practice the width of this area need not be more than, say, 10 thousandths of an inch ; this will permit the drill point, when required, to be readily restored to its original form. It is important that drills used for machining brass and bronze should not have the diameter at the tip reduced as a result of wear, as this will cause the drill to bind and, perhaps, seize in the work when a deep hole is being drilled.

Countersinking

Countersinks are also liable to dig-in when machining these alloys, and this gives rise to an irregular and inaccurate hole showing multiple chatter marks. With the ordinary type of countersink, having four or more cutting lips, this

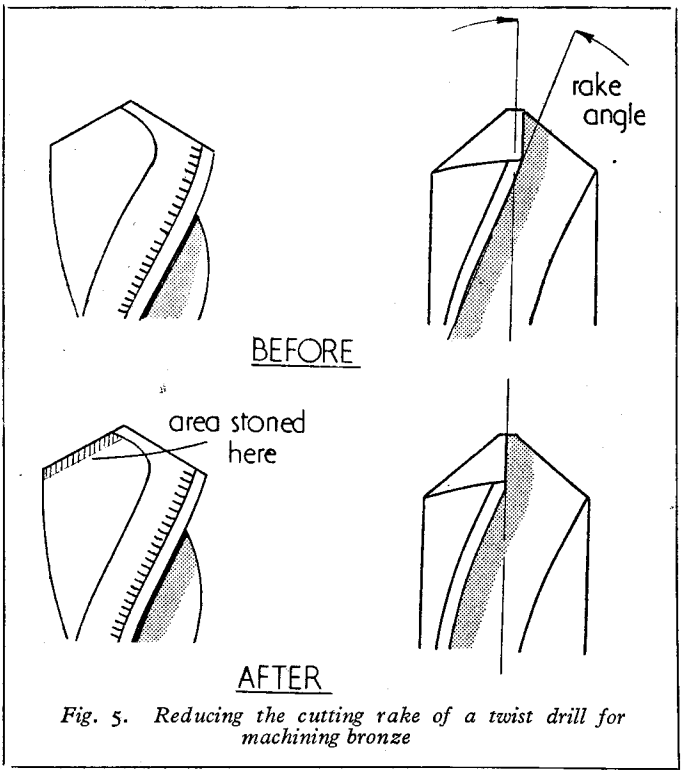


Fig. 5. Reducing the cutting rake of a twist drill for machining bronze

digging-in is commonly the result of running the tool too fast, and it is best to keep the speed down to some 100 r.p.m. or less; in addition, this trouble will become worse if the journal and thrust-bearings of the drilling machine are not properly adjusted.

Tool for Countersinking

Accurate countersinking can, however, be carried out with certainty if the type of tool illustrated in Fig. 6 is used.

Instructions for making this useful tool were given in a previous article, but briefly, a short length of silver-steel rod has its point turned to an inclined angle of 90 deg., and is filed down to the diameter line before being hardened and tempered.

Only one lip cuts, and the other serves merely to guide and steady the tool's point in the work. This form of countersink can be run much faster than one of the multi-flute variety and, at the same time, there is but little danger of chatter developing.

Milling

Both brass and bronze are readily machined with a circular cutter or with a fly-cutter or an end-mill, but it is essential that the cutter should be really sharp if a good finish is to be obtained. A milling cutter that has done much work on steel will not cut well, nor will it leave a satisfactory finish, until it has been resharpened. This is quite understandable, as a file that is kept for use on steel is not expected to cut brass effectively. Components should not be milled until they have been freed from sand and scale, for this omission may lead to the cutter becoming quickly blunted and made unserviceable.

On the other hand, castings can readily be machined in the shaping machine if a tungsten carbide-tipped tool is used.

Easily Distorted

When setting up brass and bronze components for machining, care must be taken in applying the clamping devices, for these materials are easily distorted if the pressure is too great or the clamps bear on weak parts of the work. To save damaging the work, any surfaces that have already been machined should be protected by card packings when applying the securing clamps.

Tapping

Unlike soft brass, bronze is but little set up and the threads squeezed to shape by the action of the tap; the tapping hole can, therefore, be drilled only slightly larger than the theoretical core diameter of the tap. For example, when threading a batch of gunmetal castings $\frac{1}{4}$-in. B.S.F., a 13/64-in. diameter tapping drill was used to give a depth of thread engagement equal to 95 per cent. of the full value. This

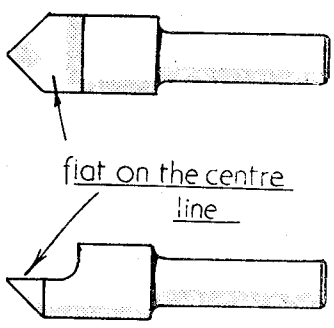
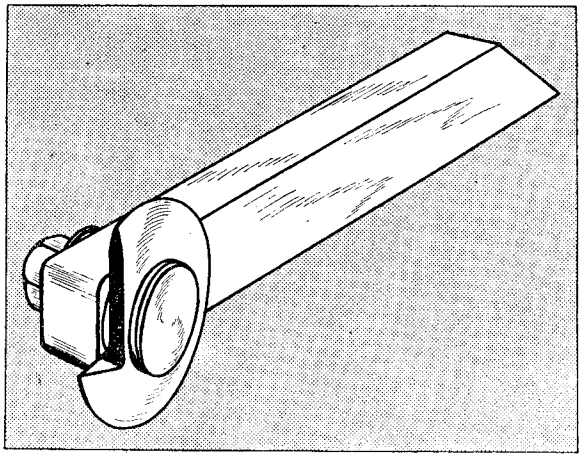


Fig. 6. A non-chattering form of countersink

is substantially greater than the 75 per cent. depth of engagement considered sufficient for mild-steel parts. For further information on tapping sizes, readers may consult *Screw Threading and Screw Cutting*, published by Messrs. Percival Marshall, where this subject is dealt with in detail.

A Cheap Long-Life Screwcutting Tool

by S. E. Capps



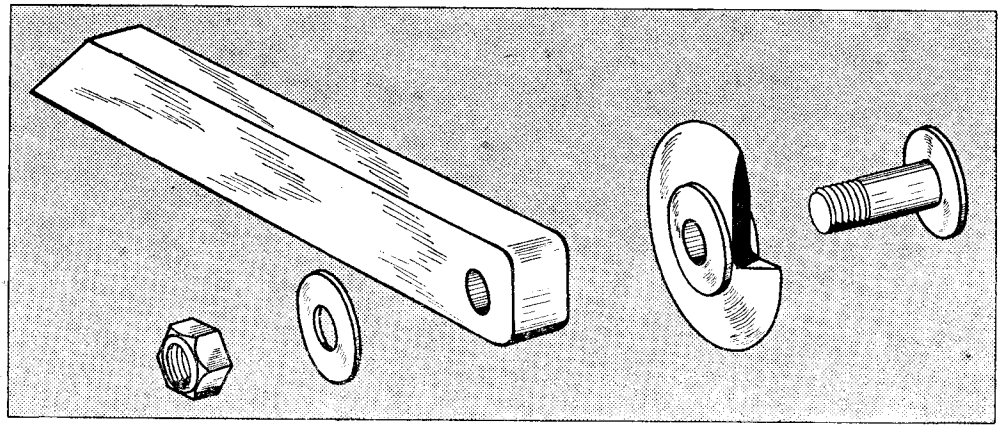
PERHAPS the most fragile tool used on the lathe is the one for screwcutting. Its point must always be correct or it will not cut a good thread. Consequently, it has to be frequently reground to shape, and because of its small section at the cutting point its life is short. It very often happens that just when the tool is wanted it needs reshaping or possibly renewing. The writer has been caught on several occasions in this manner, so made the tool shown in the sketches. This took about half the time required to make an ordinary tool and harden it.

The cutter shown was a wheel taken from an old tube-cutter which had a piece broken out of its edge and was useless for its original purpose. Although the combined angles of the sides on this one were very near 60 deg., it is not so on all of these cutters. Some are thicker and, therefore, the combined angle is not so sharp. It is, however, a simple matter to regrind them to the proper angle. The cutter in question was ground as shown, and a suitable holder made from mild-steel and drilled the same as the wheel bore.

A cast-steel bolt was next turned to fit both holder and wheel, and fitted with a good machine nut. The bolt was made from cast-steel so that its head could be as thin as possible, in order to use the tool as close to the chuck as possible. The assembly, as can be seen from the sketches, is simple and it will be understood that, as the tool is reground, it can be readjusted to centre height by revolving the cutter on the bolt. It will also be obvious that as the angle is the same all round the wheel, its life is many times that of an ordinary screwcutting tool.

The writer is aware that screwcutting tools such as the one described and other types are available, but they are expensive, being many times the cost of a tube-cutter wheel.

In conclusion, the writer's opinion is that such a tool as described is well worth the making, as it removes one of the irritating tasks that one all too frequently meets in the workshop.



The component parts of the screwcutting tool

PRACTICAL LETTERS

"That Wonderful Year . . . "

DEAR SIR,—In 1858, Frederick C. Bakewell wrote a scientific book describing some of the most remarkable applications of science up to that time. He reverently concluded his work with a profound and philosophic observation.

"It is only by tracing each invention to its source, and by noting the step by step advances by which it has arrived at its present state, that we can bring ourselves to believe that the great development of power and the display of ingenuity we witness, can be accomplished by ordinary men. This feeling of admiration, at the results of human industry and inventive genius, was strongly excited on passing through the wonderful collection of the works of all nations in the Great Exhibition of 1851.

"After walking through the long avenues crowded with the most highly finished manufactured goods, and with works of art, adapted to every purpose and capable of gratifying every luxurious taste of civilised life, we beheld, in another part of the building, the self-acting machines by which many of those productions have been manufactured.

"We saw various mechanisms, moving without hands to guide them, producing the most elaborate works; massive steam engines—the representatives of man's power—and exquisite contrivances, displaying his ingenuity and perseverance; and we felt inclined to exalt the attributes of humanity, and to think that nothing could surpass the productions there displayed. But as if to repress such vainglorious thoughts, there stood in the transept of the building, surrounded by and contrasting with the handiworks of man, one of the simplest productions of Nature.

"Every single leaf on the spreading branches of that magnificent tree exhibited in its structure, in its self-supporting and self-acting mechanism, and in the adaptation of surrounding circumstances for its maintenance, an amount of intelligent design and contrivance and power, with which there was nothing to compare. After examining the intricate ramifications of arteries and veins for spreading the sap throughout the leaf, and the innumerable pores for inhaling and exuding the gases and moisture necessary for its continued existence; after carrying the mind beyond the beautiful structure itself, to consider the provisions of heat and moisture and air, without which all that mechanism would have been useless; and having reflected on the presence of the mysterious principle which actuated the whole arrangement of fibres, and gave life to the crude elements of matter—we could not fail to be impressed with the insignificance of the most elaborate productions of man, when compared with the smallest work of the Omnipotent Creator."

Truly the foregoing is worthy of contemplation, and a subject on which to soliloquise.

Yours faithfully,

Cannochy, Staffs. H. R. LANGMAN.

The Model "Fowler 12-Footer"

DEAR SIR,—May I thank you for publishing the excellent photograph of my little cardboard "Fowler 12-footer," on September 27th. I am thinking it was a "new one" on some of our traction engine fans. The detail in the model is very crude, as it was completed in four evenings, and copied from a photograph which showed the left-hand side only. I had to "guess" the rest.

For the benefit of any readers who may be interested, this "12-footer" appeared in 1884 and was built to special order. It is believed that wheels of this diameter have never been equalled in any other type of tractor. Mr. Hughes has already given the most interesting data on the machine; but it is interesting to note that it was unsuccessful in many ways, the weight factor was tremendous, and owing to stones and mud being carried up over the driver's head and then being deposited on him, to say nothing of the sick headache experienced from working between those flickering spokes, one can imagine it being somewhat unpopular! I am indebted to Messrs. Vigzol Oils Ltd., for the publication entitled "Farm Tractors" from which I gained the data and photograph.

Yours faithfully,

Bognor Regis. WILLIAM P. WESTBROOK.

Small Steam Turbines

DEAR SIR,—The recent articles by J. A. Bamford, and D. H. Chaddock which commenced in January 1951, are most interesting, and make one regret all the more that THE MODEL ENGINEER no longer publishes articles on the theories underlying design, as they did 45 years ago. However, the following comments are prompted by J. A. Bamford's article.

The commercial De Laval five-horsepower turbine used a wheel 3.8 in. diameter running at 30,000 r.p.m.

A wheel $3\frac{1}{8}$ in. diameter should be capable of developing three horsepower and require about 80 lb. of steam per horsepower hour.

With a boiler plant, as efficient as that designed by H. H. Groves and referred to by D. H. Chaddock in his article (page 18, Vol. 104, No. 2589), the weight required to provide the steam for a 3 h.p. turbine, with a wheel $3\frac{1}{8}$ in. diameter, would be 21 lb.

While the rim speed of the smaller commercial De Laval turbines was only 515 ft. per sec., that of the larger ones was 1,378 ft. per sec. 1,300 ft. per sec. is as high a rim speed as any amateur constructor should risk, at which the maximum safe r.p.m. of a $3\frac{1}{8}$ in. diameter wheel would be 95,400.

Good luck to all those who strive to win the speed-boat records with steam turbine drive, but the question of weights would seem to limit the turbine to a smaller wheel than 3 in., and a power nearer 1 horsepower. There is not much hope of reducing the steam consumption in these very small sizes below 80 lb. per h.p. hour.

Yours faithfully,

Bishop Stortford. A.W.P.